SCIENTIFIC AMERICAN

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HARDENING COMPOSITE PLATES FOR BANK VAULTS.

The manufacture of iron and steel burglar-proof vaults for insurance companies, trust companies and similar institutions is one of increasing importance. As the safe maker advances in his processes, and while he is improving the burglar-proof quality of his safes, so fast does the burglar improve in his method of attack, so that it is often the burglar himself who is in advance of the safe builder.

The illustration accompanying this article shows a somewhat curious operation incidental to the manufacture of steel and iron vaults, the hardening of the plates. The process is the one employed at the works of J. B. & J. M. Cornell, in this city, and consists in dipping the hot plates into salt water. Advantage is taken of the water front held by the firm in utilizing *in situ* the salt water of the Hudson River for the purpose, a brine dip being considered superior to one of fresh water. There is unquestionably a difference between the two. The addition of a soluble salt to water raises its boiling point, and to some extent improves its hardening power.

A curious and unique industry in this city is represented in the plant in question. Special heating furnaces are built in the open air upon the margin of the river, and plates of steel heated in them are dipped into the river to harden. Except for docking and shipping purposes, it is about the only technical use made of the river proper.

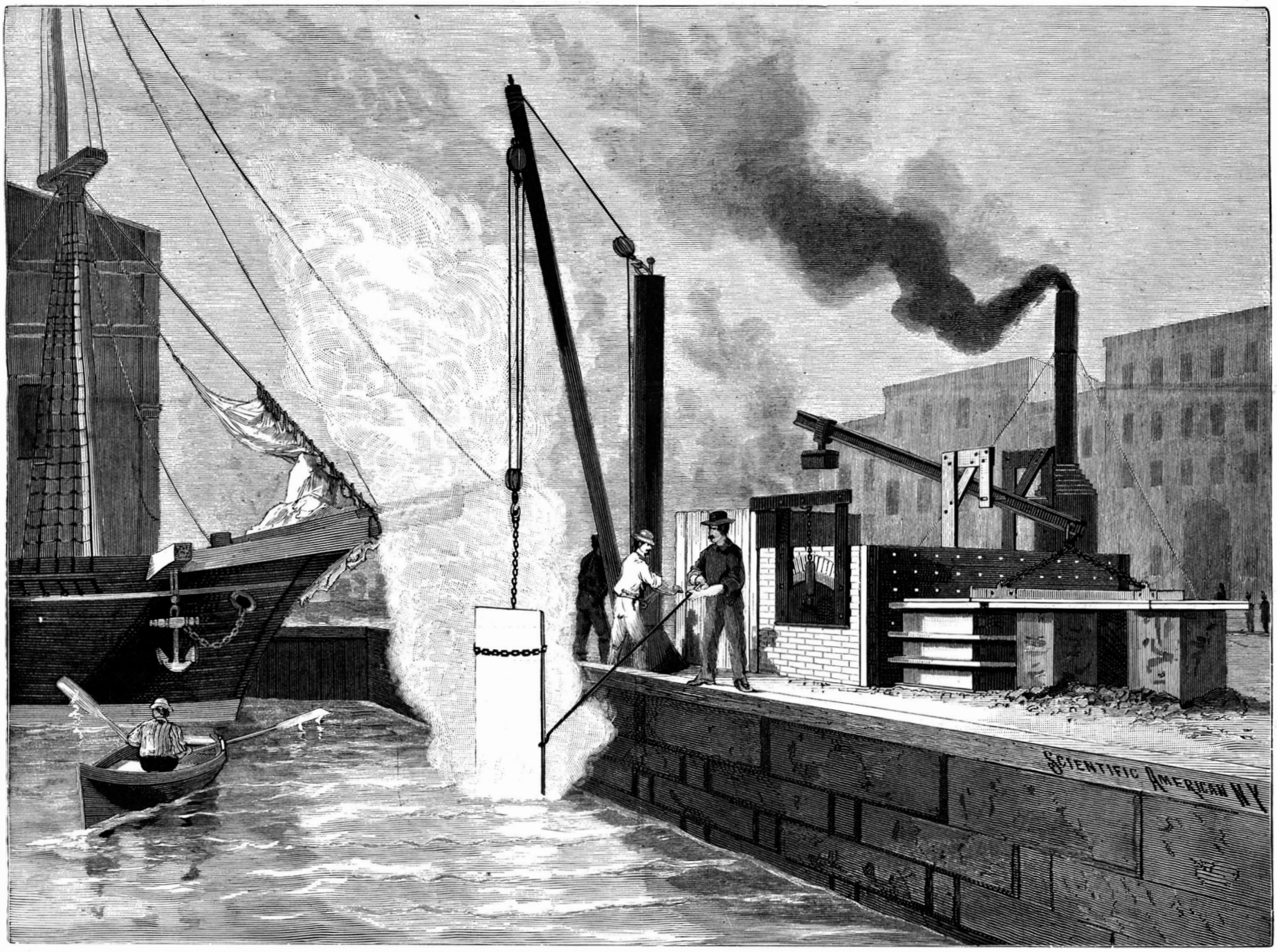
Curious as is this step of the process, the general manufacture of the vaults is of great interest. They are made of steel and iron. For the walls of vaults a composite plate is used, consisting of five alternate layers of soft steel or iron and of hard steel. In the center is a layer of soft steel or iron, next to it come two layers of chrome steel, one on each side, and outside of all are the two layers of soft steel or iron. These plates are rolled of various thicknesses, the different layers welding together, plates one inch thick and one half inch thick being most generally used. For the corners angle irons made of the same material are used.

The safe walls are built up of the composite plates, laid against each other and screwed together. In one usual construction the outside plate is an inch thick. Next to it comes a half inch plate, secured to the outside plate by flat-headed screws, whose heads are countersunk in the half inch plates, while their ends screw into blind holes in the one inch plate. The next plate, also a half inch one, is screwed to the second plate in a similar manner except that the tapped holes in the first half inch plates go entirely through. In this way a wall of any desired thickness is built up, one object on constructing it of such thin material being to secure frequent breaking of joints.

The work on the plates, including the drilling and tapping of holes, shaping the edges, etc., has to be done while they are soft. The entire vault is built up of the unhardened plates, each one having its exact place assigned it. The vault is next taken down, piece by piece, and the pieces are hardened. It is this operation which we illustrate. On the edge of the dock on the North River front near the foot of Twenty-Seventh Street in this city reheating furnaces have been built adapted for heating the metal to redness. The plates are put in and are brought to a good red heat. They are then removed from the furnaces and as quickly as possible dipped edgewise into the river. In this way they get a salt water hardening. They are then to be rolled cold for the purpose of straightening them. Previous to the heating the blind holes in the one inch plate are stopped with clay to prevent cinders from getting in. After rolling, flattening, and cleaning the plates are ready for shipping and erection.

The object of the combination of hard and soft iron is to secure the safe against attack by sledge or by drill. A drill could hardly be forced through the chrome steel, and at best it is only after many hours' work that the material can be perforated. Again, on account of the soft iron, sledging is without effect, for even if the hard steel should be cracked, it is so embedded and welded to the adjacent layers of soft iron that no harm is done. In one great vault now building by J. B. & J. M. Cornell for the Equitable Life Insurance Co.'s Boston office as an additional protection, a vault of the construction just described is to be erected within a protecting structure, built up of a special section of 54 pound railroad iron, rolled for the purpose.

A species of cage for the safe is made up of these rails laid interlocking, with their interstices filled with Portland cement. Inside of the rails the steel structure described is made up, the inch plates being first put in position and the half inch plates screwed to their inner surface. The vault is to have two doors, each with its time lock, and moving on ball-bearing hinges. Each time lock has three clocks, any one of which will operate it, so that as long as one clock out of six is in order, the vault will open.



HARDENING COMPOSITE PLATES FOR BANK VAULTS BY IMMERSION IN THE HUDSON RIVER.

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AN AMERICAN BULLET PROOF SHIELD.

Mr. W. J. F. Lennard, a stairbuilder, of Brooklyn, N. Y., has invented a bullet proof shield claimed to be superior to that of Herr Dowe, the Mannheim tailor, described in the last issue of the SCIENTIFIC AMERICAN. It is said to be composed of cotton, felt, wood, and a chemical compound of parts mineral and vegetable. A public test of the bullet proof qualities of the new shield was made at one of the Brooklyn parks on July 12. It was in the form of a pad seventeen inches long, thirteen inches wide, and a trifle less than two inches thick, being somewhat flexible, and weighing eleven pounds. This pad was hung on the neck of a wooden figure, and shot at by a marksman with a 45 caliber army rifle, the cartridges being loaded with seventy grains of powder and 405 grains of lead. The bullets partially penetrated and embedded themselves in the pad, but did not go through it. The inventor afterward put on a similar pad, and was shot at by the marksman, the same gun and cartridges being used, when the shield proved an effective protection against the bullet. The inventor said there was no feeling from the impact of the bullet, except a slight sensation as if some one had poked him with a finger. The inventor does not claim that this shield would be effective against steel bullets, but only against lead bullets. His shield is the result of experiments for a composition to use in armoring ships, which he claims will be lighter and better than steel plates.

FAILURE OF A LARGE ARMOR PLATE.

An armor test of a Carnegie nickel-steel Harveyized plate, seventeen inches thick, took place at the Indian Head proving grounds on the Potomac near Washington, July 12, and like the eighteen inch Bethlehem plate tested May 19, ended in the failure of the plate. The same gun—the 12 inch rifle—was used in both cases. The plate was secured to a 44 inch oak backing, heavily braced. The distance of the gun from the target represented a range of about 1,200 yards. The Carpenter projectile weighed 800 pounds and was propelled by 260 pounds of brown prismatic powder; the muzzle velocity was 1,410 feet per second. The first projectile fired penetrated 13½ inches and then bounded back 50 feet. In the second Wheeler-Sterling shot the velocity was increased to 1,858 feet per second and the striking energy was advanced to 20,370 foot tons. The havoc wrought was terrible; the shot crashed through the plate and backing, deflected up, and landed 300 feet away. The head of the shot was somewhat injured, but the body of it was intact. The result was a great surprise to all concerned, especially to the makers, who had used all possible care in its fabrication, the plate being left in the Harvey furnace for twenty-eight days. Upon this test depended the acceptance of 287 tons of armor for the battleship Oregon, worth $246,000. The loss to the company for the plate, even if the armor is finally accepted, will be $20,000.

The Secretary of the Navy ordered another test the next day, using the same shells as were used in the June test of a Bethlehem plate. The Carpenter projectile penetrated the plate and stuck fast in it; the plate was cracked. The Navy Department will conduct exhaustive tests on Harveyizing armor before accepting more plates.

EDUCATION IN AMERICA.

We publish in the SCIENTIFIC AMERICAN SUPPLEMENT of this week a very remarkable paper on the schools of America, by Duane Doty, Superintendent of Public Instruction of Chicago. It is a summary of the last report, just issued, of the United States Bureau of Education. From the earliest days of the republic, the necessity of education for the people has been a generally accepted doctrine, and the impost of taxes for the purpose has been generally acquiesced in willingly. It is hard to see how any substitute for the public schools could be invented. It would seem more logical for each individual to pay for the education of his own family. But private schools would never be so widely distributed as are the public schools. In the rural districts, far from any village of account, will be found the public school, to which children resort from miles away in all directions. Private enterprise would never do the work done by the rural public schools.

The statistics and data contained in the article referred to are of deep interest. They go to show what an immense machinery is used in public school education, and reveal an industry of the largest dimensions devoted entirely to intellectual culture and advancement. The same statistics show the rapid growth of the system. Every year sees it more developed and more difficult of replacement. The great area of our country is one of the causes which will tend to make it permanent.

The paper referred to, however, is devoted to education in general, not merely to the public school system. It shows that as the higher departments are reached, the percentage of scholars attending private schools increases. But the facts that in the elementary grade of public school ninety per cent of the school population are educated and that in all schools and colleges together the public schools and colleges educate eighty-nine per cent are impressive. The agency which controls the education of so large a proportion of the population of the country is one which should receive the greatest consideration and care from those administering it, for education can be a power for evil as well as for good.

BROOKLYN MEETING OF THE A. A. A. S.

The scientific and educational institutions of Brooklyn have united in inviting the American Association for the Advancement of Science, with its affiliated societies, to hold its forty-third annual meeting in that city. The hotel headquarters of the officers and others will be at the St. George Hotel. The official time as announced will be from August 15 to August 24, although some of the special societies may meet earlier or later than those dates. The opening sessions will be held daily in the Polytechnic Institute, the evening addresses and receptions will be in the Academy of Music and Art Building, and the sections will meet in the rooms of the Packer Institute. Every facility for lantern illustration will be in constant readiness for the day meetings, as well as when required in the evening. Many eminent foreign scientists have accepted invitations to be present, which will add much to the interest of the occasion.

Excursions have been planned for combining science with social pleasure to various mines, quarries, mountains, cliffs, and marl beds; to Long Branch for the study of marine algæ; to Cold Spring to inspect the State fish hatchery; to West Point to inspect the Palisades and Highlands and Military Academy; various local trips to points of interest about the harbor, navy yard, etc., and finally, at the close of the sessions, an excursion to the Forestry Congress at the White Mountains. These plans are liable to be modified, and additional ones may be arranged for, of which notice will be given in due time. As far as possible these excursions are to be free, or at greatly reduced rates. The regular railroad rates to and from the meeting will be reduced, and special terms are to be had for hotel accommodations. Concessions will also be made by the express, telegraph, and telephone companies. In a word, everything will be done to make the Brooklyn meeting delightful and successful.

Full information can be had on application to the local secretary, Prof. G. W. Plympton, or to Mr. E. T. Johnson, relating to hotels and lodgings. It will be sufficient to address simply in care of A. A. A. S., Brooklyn, N. Y. Communications as to scientific papers, membership, etc., should be made to Prof. F. W. Putnam, permanent secretary, Salem, Mass.

THE GREAT RAILROAD STRIKE.

It is an accepted doctrine in political economy that the loss of one person's property is the loss of all. When a building burns in a large city, in some form or other the entire community has to bear the loss. Property is never destroyed without all suffering in some way. In the science of government a very general opinion is expressed in the saying that the best governed people is the least governed. Like some other sayings this cuts both ways; there is no doubt that a community of individuals, so orderly and well-behaved as to require but little government, would live very happily, and from their very nature would, in being self-governed, be little governed and well governed. But unfortunately the law has to deal with all classes of men. America especially has been receiving the outpourings of Europe for many years, and there is a strong feeling that the class of immigrants of the last ten or twenty years does not compare favorably with those of the preceding epoch.

The law throughout is based on the doctrine of expediency. A country governed by strictly logical laws would be far from practicable, at least under present conditions. The object of government being the preservation of order and peace and the prevention of crime, the law should secure these ends by the simplest and most efficacious means possible. Thus in a large city, if a given procession of innocently disposed people would be the occasion of a riot, no complaint could be made if the police took the practical though illogical step of prohibiting the parade and preventing the riot.

The great strike which has occupied so much of the attention of the country during the last few weeks is apparently on the point of collapse and illustrates the above points. The Federal troops have gone into action and seem to have done good work at the expense of very few lives. A vast amount of property has been destroyed, striking workmen have lost an immense sum in wages, and Cook County, Illinois, together with other railroad centers where rioting has taken place, will probably be burdened with a very heavy tax bill for the payment of damages to property incidental to the rioting. Incalculable harm has been done and the entire United States will have to foot the bill. It is easy enough to criticise the use of the Federal troops in the matter, it is natural for local militia to object to fight their own neighbors and friends, it is well for the upholders of the strong arm of the law to exult in the

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thought of the suppression of mob violence by military force, but a question of the utmost difficulty of practical politics lies back of it all. How are strikes with incidental riots and destruction of property and idleness of thousands of workmen to be prevented in future.

The evils of a strong government for the repression of riots on the one side are confronted with the evils of a weak government unable to cope with the evil-disposed classes. In the United States, by general consensus, the Federal power is recognized as the strong element, one to be called on as seldom as possible, and whose direct intervention is looked on with disfavor and as an unfortunate necessity. The individual States are less powerful and less arbitrary in their governmental actions. Both have united in coping with the rioters. But until strikes of the magnitude and evil effects of the present one are made impossible, until the paralysis of a country's business by enforced idleness of workmen supplemented by rioting becomes a matter of history never to be repeated, the laws of the country will not be perfect.

We may object to being too much governed, but a comparative despotism is preferable to a condition of things involving the calling out of soldiery to cope directly with what should be a peaceful populace of workmen. War with a foreign power is held to be a not unmixed evil; civil war, and fighting with mobs, are bad in every sense—in cause, in prosecution and in results.

To-day millions of people are suffering from the strike. Its consequences may last for many months to come. Pittsburg is still paying for the damages done during the riots of 1877. Expediency calls for the prevention of such occurrences, and an evasion of the strict laws of logic may be excused if such prevention can be brought about by a law, even if it be one of expediency only.

LAYING AN ATLANTIC CABLE IN TWELVE DAYS.

On the 2d of July the Faraday completed the laying of a new Atlantic cable, the actual time occupied in the work of laying the deep sea portion being but twelve days. When the Great Eastern, in 1866, completed the laying of the first successful Atlantic cable, the entire world joined in congratulations. The event was justly looked upon as marking an era in the progress of the world. Since that time, however, the making and laying of ocean cables has become a practical, everyday business, and the new cable was not only laid in the shortest time, but is a much better cable than any of its predecessors, having the largest copper conductor and being the speediest ever laid for its length.

Although the Faraday left Woolwich on June 12, she did not, owing to unfavorable weather, reach the vicinity of the previously laid and buoyed shore end of the cable, off Waterville, Ireland, until the 18th, and then, the buoy rope, having been wrenched off by a passing propeller, had to grapple for the cable itself, at a depth of about 250 fathoms. Such work now presents no substantial difficulties. The heavy grapnel, attached to 600 fathoms of chain and rope, was three times dragged across the cable's path, when the cable was hooked and hauled up, two miles inside of the end that had been buoyed. The end communicating with the shore was at once tested and spliced to the cable in the tanks, the other piece hauled aboard and the buoys picked up, when, at 10:30 A. M. on the 20th, the vessel was ready to start on the actual work of laying the deep sea cable. At the rate of about seven knots an hour the cable passed up round the core in the center of the tank, along the troughs and directing sheaves, under the sheave of the strain-measuring dynamometer, and sank to the ocean's bed. For several hours the depth varied from 250 to 500 fathoms, when a great declivity was reached and 1,000 fathoms were indicated, followed by a varying bottom, nearly three miles deep in places. Thence it gradually rose to 1,600 fathoms, dropping subsequently to over 3,000, as hill top and valley in the ocean bottom were passed, until the shallow water of the Newfoundland Bank was reached, some seventy-five miles from the buoyed end of the previously laid shore end on the American side, 502 miles from Canso, Nova Scotia. During all this time communication was constantly kept up with the Waterville station, the news of President Carnot's assassination being received on the Faraday the evening of its occurrence. When at 1,585 knots' distance from the Irish coast, and the soundings indicated a depth of 891 fathoms, the lighter deep sea portion of the cable was spliced to a shallow water type, which was continued to the still heavier Canso shore end. Fogs, icebergs, and bad weather prevented the finding of the buoy on this shore end, but after a good deal of dragging the cable was hooked and drawn aboard on the 30th, just ten days from the actual start on the other side, although the final splice was not completed until the morning of July 2.

The new cable was laid for the Commercial Cable Company, being the third cable of that line. It was manufactured and laid by Messrs. Siemens Brothers & Co., who have very extensive works at Woolwich, England, for the manufacture of electrical appliances. The Faraday was specially constructed by the Siemens Brothers for the work of cable laying, and has three large tanks for the storage of cable, with many ingenious appliances to facilitate the paying out, grappling, and hauling up and making all the delicate tests required in all stages of the work. The new cable has a much greater weight of copper conductor or core and of gutta percha insulation than any of the cables previously made. The shore ends and intermediate sections of the new cable comprise about 700 nautical miles and the deep sea portion is nearly 1,600 nautical miles in length.

Eight Hours in England.

The forty-eight hours week has lately come into operation in all the British government works, and new regulations have been forwarded to the works. A careful examination of these, says *Engineering*, indicates that in making the concession the Admiralty have withdrawn many privileges, which in great measure counterbalances the less number of hours worked, and by this means at least they bring the dock yards into line with the private establishments throughout the kingdom. The men will still have the four public holidays as hitherto without loss of pay; but the half holidays on the occasion of a launch, or of a visit of the Lords of the Admiralty, are to be discontinued. Nor will a half holiday be given for a parliamentary election, since the polling booths are now open until eight o'clock. Hitherto three minutes has been allowed the workman to go from the yard entrance to his work every time he enters the works, which meant thirty-three minutes per week. This is discontinued, and the men must be at the pay ticket box close to their work at the time of starting. The five minutes allowed to get to the pay table is discontinued. Hitherto an hour was granted in the morning or evening without stopping of pay in the event of urgent family affairs. No such excuse can now be accepted, while grant of leave without loss of pay to attend Confirmation is also to be discontinued, and blacksmiths will not now have ten minutes to wash each time they leave the works. Again, overtime pay, *i. e.*, time and extra, will only be granted after the men have worked a full 48 hours in the week. It frequently happens that a Saturday precedes or follows a public holiday—Good Friday, Whit Monday, etc.—and on such occasions the men used to work overtime before the holiday to make up the time to be lost on Saturday when not infrequently the machinery was running as usual. This is not to be allowed in future, even if the works are closed on the Saturday, the desire being to meet the men's demand for no overtime, except, of course, where the exigences of the service urgently require it. In this one almost recognizes an Admiralty Roland for the workmen's Oliver. As to the hours fixed, these vary to suit the seasons of the year, the day being shortest in the winter months, 7¼ hours, and longest in the summer and early autumn, 9 hours. On Saturday the duration is 5 hours throughout the year. The earliest start is 7 A. M., and from December to March it is 7:30 A. M., and the hour of closing the work is 4:15 to 5:30 P. M., 1½ hours being allowed at midday for dinner. These are the hours for Portsmouth, Chatham and Sheerness, while for Devonport and Pembroke, which are further west, they are a quarter of an hour later. The hours are for the beginning and starting of work, no allowances being made. The variation in the hours involved the readjustment of the day pay ratings to bring the 48 hours pay to the same as the 51 hours pay; but no change is made in overtime rates, so that in the latter case the same work must be done in the 48 as in the 51 hours week to earn the same sum. The writing staff will continue to work 45 hours, but overtime rates will only be paid after 48 hours have been worked, instead of after 51 hours work as heretofore. Enginemen, stokers, and furnacemen will work longer hours, as at present, to have the plant ready for the workmen.

Spontaneous Combustion.

When charcoal which has been allowed to absorb as much sulphureted hydrogen as it can take up is introduced into oxygen gas, the charcoal will burst into flame, owing to the energy of the action of the oxygen upon the sulphureted hydrogen.

This fact is stated in most text-books on chemistry, but no description that I have ever seen of this experiment is calculated to bring about the effect with certainty. The following is a simple method for illustrating this reaction upon the lecture table, which I have never found to fail:

A few grammes (from five to ten) of powdered charcoal are introduced into a bulb which is blown in the middle of a piece of combustion tube about twenty-five centimeters long. A gentle stream of coal gas is then passed over the charcoal, which is heated by means of a Bunsen lamp until it is perfectly dry. This point may be ascertained by allowing the issuing gas to impinge upon a small piece of mirror, and when no further deposition of moisture takes place the charcoal may be considered to be dry, and the heating may be stopped. The charcoal is then allowed to cool in the stream of coal gas until its temperature is so far reduced that the bulb can just be grasped by the hand, when the coal gas is replaced by a stream of sulphureted hydrogen. The sulphureted hydrogen should be passed over the charcoal for not less than fifteen minutes, by which time the bulb and its contents will be perfectly cold, and the charcoal will have saturated itself with the gas. (In practice it will be found convenient to prepare the experiment to this stage, and allow a very slow stream of sulphureted hydrogen to continue passing through the apparatus until the experiment is to be performed.) The supply of sulphureted hydrogen is then cut off, and a stream of oxygen passed through the tube. Almost immediately the charcoal will become hot, and moisture will be deposited upon the glass. The supply of oxygen should be sufficiently brisk to carry the moisture forward from the charcoal, but not so rapid as to prevent it from condensing on the glass tube beyond the bulb. In a few moments the temperature of the charcoal will rise to the ignition point, when it will inflame and continue to burn in the supply of oxygen. —*G. S. Newth, in Nature.*

A Coloring Matter for Grapevine Leaves.

The green portions of plants contain besides chlorophyl, as a rule, only a yellow coloring matter, called carotin, chrysophyl, or erythrophyl, which is insoluble in water. Several investigators find, however, that some kind of leaves give aqueous extracts of a more or less impure yellow color, an observation which is explicable from the fact that in most of these instances mature leaves were used. Young leaves yield an almost colorless extract. Yellow autumn leaves, however, contain considerable quantities of soluble coloring matters. Thus the authors found that fallen beech and horse chestnut leaves give deeply colored aqueous extracts. They have also succeeded in isolating a yellow coloring matter from vine leaves, the investigation being suggested by the use of these leaves for dyeing purposes in Persia. Like most vegetable coloring matters, this substance is a glucoside. It can be prepared by the addition of lead acetate to the decoction of the finely powdered leaves, treatment of the precipitate formed with sulphureted hydrogen, and subsequent extraction of the dried lead sulphide with boiling alcohol. The residue, obtained by evaporation of the alcohol, is freed from sulphur by means of carbon bisulphide, the glucoside remaining as an indistinctly crystalline brownish yellow substance. By boiling with dilute sulphuric acid it is split up into a sparingly soluble brown body and glucose. This coloring matter may, after washing with water, be purified by adding to its alcoholic solution an alcoholic solution of lead acetate and treating the previously washed and dried bluish green precipitate with ether containing hydrochloric acid, by which the impurities are taken up. The remaining coloring matter is then dissolved in alcohol and precipitated from this solution by the addition of water. It forms a reddish brown powder, soluble in alkalies with a brown color. Its aqueous solution produces upon chrome mordanted wool fine brown shades, and dyes wool mordanted with tin a fine yellow. The coloring matter may possibly be of practical value. The vine leaves were also found to contain up to two per cent of potassium hydrogen tartrate.—*E. Schunck, E. Knecht, and L. Marchlewski.*

Sugar as a Promoter of Muscular Power.

The subject of sugar as a food producing muscular power has been discussed by Dr. Vaughan Harley. During a twenty-four hours' fast, on one day, water alone was drunk; on another, 500 grammes of sugar were taken in an equal quantity of water. It was found that the sugar not only prolonged the time before fatigue occurred, but caused an increase of 61 to 76 per cent in the muscular work done. In the next place, the effect of sugar added to the meals was investigated. The muscle energy producing effect of sugar was found to be so great that 200 grammes added to a small meal increased the total amount of work done from 6 to 39 per cent. Sugar (250 grammes —about eight ounces) was now added to a large mixed meal, when it was found not only to increase the amount of work done from 8 to 16 per cent, but increased the resistance against fatigue. As a concluding experiment, 250 grammes of sugar were added to the meals of a full diet day, causing the work done during the period of eight hours to be increased 22 to 36 per cent.

Vaselone.

Vaselone is a substance introduced as a substitute for vaseline. According to an analysis by Villon, it is a solution of stearone and margarone in neutral mineral oil. Stearone is prepared by distilling stearin with lime. Margarone is prepared in a similar way from beef suet. Vaselone consists of 15 parts of margarone and 5 of stearone in 100 of thoroughly purified and odorless mineral oil. The fatty product obtained, after cooling, resembles vaseline, but is not as transparent. It is white, odorless, neutral, and not affected by acids and chemical reagents.

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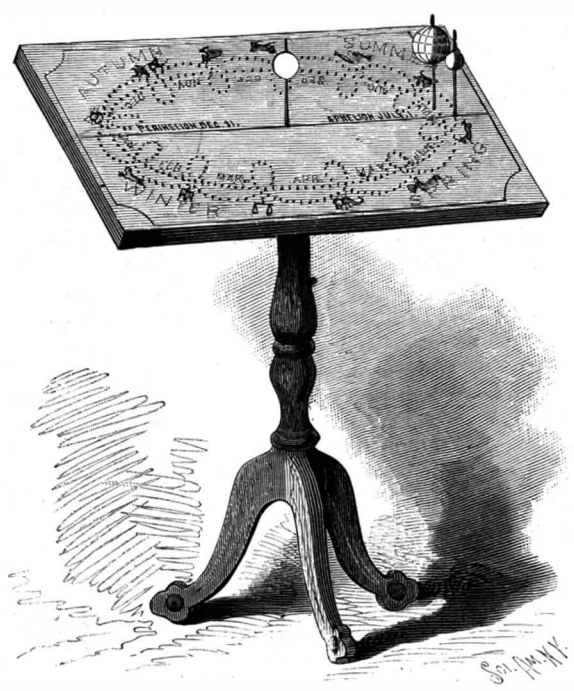
Utilization of Garbage.

The process of garbage disposal is, according to the *American Architect*, probably carried on now with greater perfection in St. Louis than anywhere else in the world. In the new establishment just completed there, at a cost of nearly a quarter of a million dollars, by the company which holds the contract for disposing of the garbage of the city, the carts bringing the material ascend an inclined plane to the third story of the receiving building, where they discharge into enormous vertical cylinders, which are surrounded by steam jackets. Superheated steam is forced into the jackets, and the water, which constitutes from 75 to 80 per cent of the garbage, is thus evaporated, or rather distilled off, the vapor being condensed, and the condensed water, which is perfectly harmless, and even drinkable, allowed to run off to the sewer.

At a certain stage of the drying, naphtha is pumped into the cylinders and allowed to remain there for thirty or forty hours. This dissolves out all the fats, oil, and grease from the mass. Other chemicals are said to be mixed with the naphtha, but this is probably for the sake of mystification, the naphtha alone being quite sufficient for the purpose. After the proper time has elapsed, the naphtha, with its dissolved oil, is pumped out again into stills, where it is distilled by steam heat, the volatile naphtha being allowed to run back from the condensers into the storage tanks, while the fat, which is left in the stills as a brown, oily mass, is drawn off into barrels. It may be bleached, so as to be perfectly white, and it is said that the pure and delicate Ivory soap, which has gained such popularity all over the country, was originally made of refined garbage grease, before it was found advisable to use cottonseed oil instead. After extracting the grease, the residuum in the cylinders is dried a little more, the last vestiges of naphtha being driven off in the process, and is then removed through a door at the bottom. It is now a brown mass, free from all unpleasant odor, and apparently dry, although it still contains 5 or 6 per cent of water. As it has not been heated sufficiently to cause destructive distillation of the solid portions, it contains practically all the nitrogen of the fresh garbage, with, of course, all the alkalies and phosphates; and, after grinding coarsely and packing in barrels or bags, it commands a ready sale all over the United States. The dealers usually analyze a sample and fix their price mainly in accordance with the proportion of nitrogen found in the sample; but the St. Louis "garbage tankage," as it is called, readily brings in New York and Boston from nine to twelve dollars a ton, and the demand for it far exceeds the supply.

AN IMPROVED TELLURIAN.

This tellurian is more especially designed for use in schools, to show without much trouble, and in a very effective manner, the causes of the seasons and the



NICHOLS' TELLURIAN.

relative positions of the sun, earth, and moon. It has been patented by Mr. Grant B. Nichols, of Wapakoneta, Ohio. It comprises an inclined table on a suitable stand, with a central recess, in which is a rod carrying a ball representing the sun, around which is a series of 365 apertures, made in the surface of the table in an ellipse, representing the path of the earth around the sun. These apertures are preferably numbered according to the days in the month, the names of which appear at their respective places, and a vertical rod carrying a globe representing the earth is designed to be placed in one of the apertures. Another series of apertures, also preferably marked or numbered, represent the path of the moon relative to the elliptical path of the earth, a rod carrying a ball representing the moon being placed in one of these apertures. The rod carrying the ball representing the earth may at any time be inserted on the proper date in the aperture provided for it, the rod carrying the moon being likewise placed in correct position, when the relative positions of the different bodies will be practically illustrated. The apertures for the rod carrying the ball representing the earth are all of the same depth, but those in the path of the moon are of different depths, so that the moon's orbit about the earth is not so much inclined as the earth's orbit about the sun, the moon being thus always represented in the proper position relative to the earth and sun.

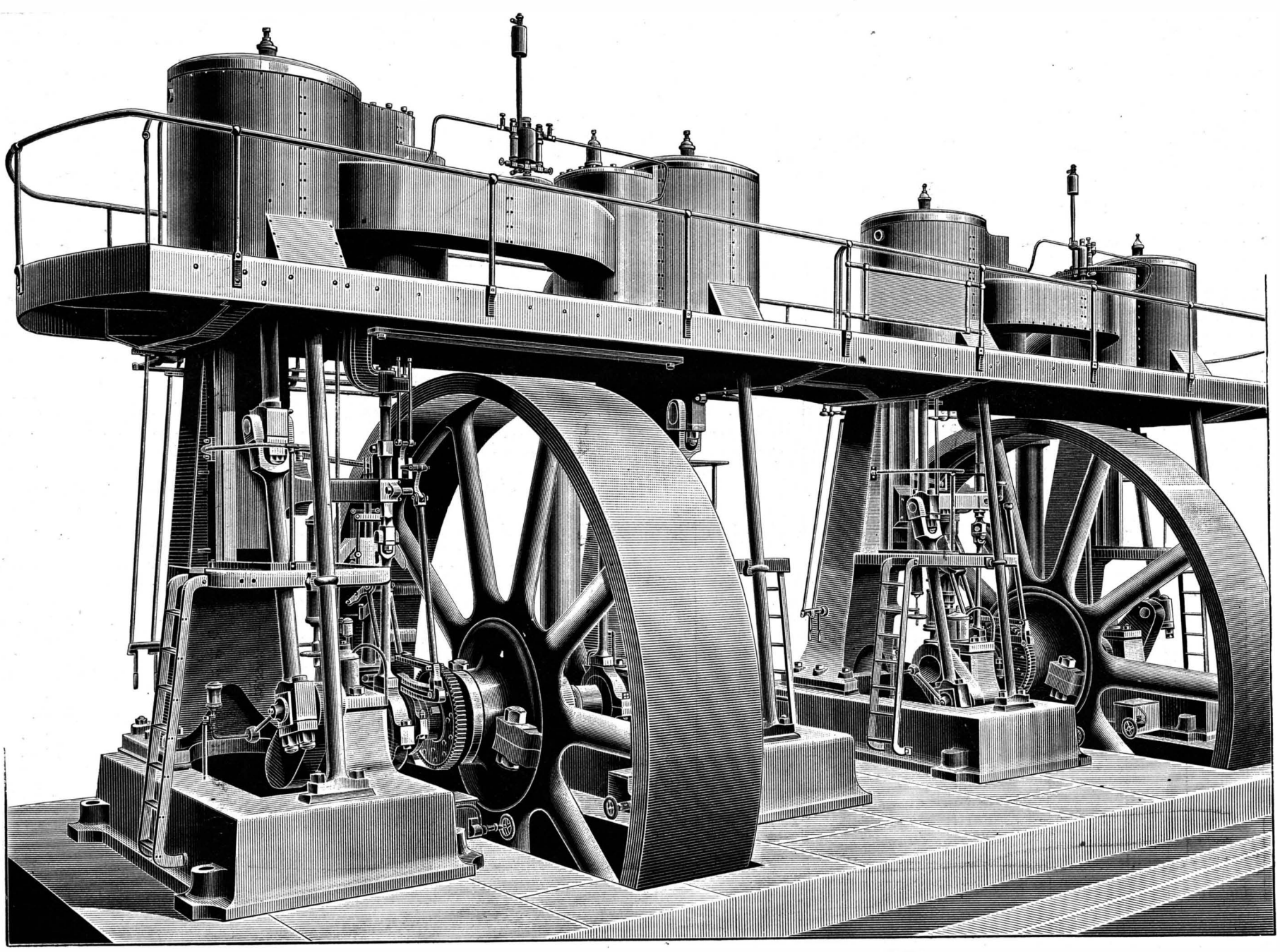
ELECTRIC LIGHT ENGINES, MANCHESTER CORPORATION.

We illustrate the engines constructed by Messrs. Galloways, Limited, for the Manchester corporation.

We are indebted to the *Engineer*, London, for our engraving and the following particulars:

The engines are arranged at either side of a gangway, this gangway giving access to the upper staging of all the engines in the installation. The steam pipes below are in duplicate, as also are the steam valves on the boilers and the stop valves on the engines, so that either series may be used at will. The lower pipe over the gang way is the water supply from the tank over the boiler house; this pipe supplies the Korting ejector condensers. The engines have high pressure cylinders 17 inches diameter, low pressure 34 inches diameter, with a piston stroke of 3 feet, and they are intended to run at a varying speed of from 75 to 90 revolutions per minute. The admission of steam is controlled by expansion valves arranged in accordance with Messrs. Galloway's plans, the gear consisting of a block working in a slotted link directly in connection with the governor. The governor is of the parabolic type adopted by Messrs. Galloway some years ago with unequivocal success, but in this case a portion of the center weight has been removed and a spring substituted to give a varying load. Both cylinders are steam jacketed, and a receiver is formed round the jacket of the high pressure cylinder, so that the two cylinders have apparently the same diameter.

THERE are 11 American cities that spread over more territory than Paris, while Berlin is exceeded in area by 17 of our cities.



IMPROVED COMPOUND ELECTRIC LIGHT ENGINES.

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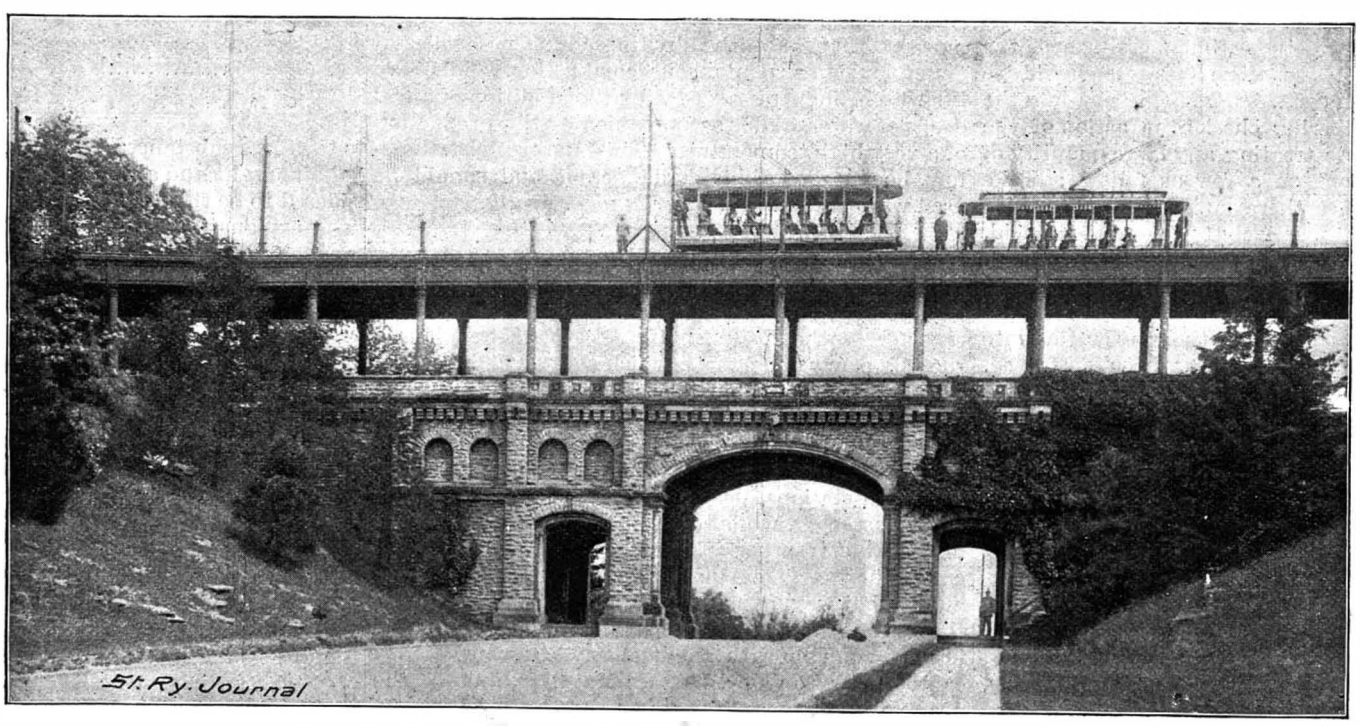
The Action of Acids upon Glass.

Experiments made with flasks of different kinds of lime-alkali glass proved that the loss of weight resulting after heating with diluted acids to 100° for six hours was always the same with the same kind of glass, and was entirely independent of the strength of the acid or of its chemical composition. Sulphuric, hydrochloric, nitric, and acetic acids gave identical results. Only very strong acids had less effect than dilute ones, which again have less action than pure water. Similar results were obtained in working at temperatures of 160° and 190° with pieces of glass tubing inclosed in sealed tubes. The influence of the degree of concentration was, however, more pronounced than in the previous experiments and was again in inverse ratio to the strength of the acid used. The dissolving action of the acids is therefore governed by the amount of water contained in them. Bearing in mind that the action of water upon glass consists in the liberation from it of alkali, which again further increases its vulnerability to water, the passive part played by the acid may be readily understood. In the case of glass containing an unusually large amount of alkali, the action of the acid, however, is more pronounced than that of pure water, the decomposition being analogous to that of many natural silicates. Lead glass exhibits the same peculiarities as lime-alkali glass, according to the proportion of lead contained in it. The nature of the base in combination with the silica likewise seems to influence the resisting capacity of the glass. Thus a zinc-lime-soda glass (Jena thermometer glass 16 III) was more attacked by concentrated acid than lime-soda glass of equivalent composition. The action of pure sulphuric acid is less strong than that of boiling water, but at very elevated temperatures its vapors produce a more marked effect.

Dry carbonic acid does not affect glass, hence the action of the atmosphere primarily depends on the aqueous vapor contained in it. The liability of a glass to suffer changes by atmospheric influences can therefore be ascertained by estimating colorimetrically the amount of alkali separated on treatment with water. Glass, especially when rich in alkali, is capable of absorbing water, which can only be completely expelled by heating to about 500° C. The water combines chemically, forming hydrates, which represent the intermediate stage in the process of the decomposition of the glass by the action of water. An important part played by the alkali split off by water seems to consist in its facilitating the formation of such hydrates.

VIADUCT FOR STREET RAILWAYS, CINCINNATI.

The business portion of Cincinnati occupies a plateau nearly three miles wide, rising abruptly about eighty feet on the north side of the Ohio River, and beyond this is an irregular line of bluffs some 400 feet high, over and beyond which the city has spread. One of these hills is known as Mount Adams, and our illustration represents a view on the Mount Adams and Eden Park Railway, forming part of the street railway system of Cincinnati, the park being on a hill in the eastern part of the city, and containing two hundred acres. The heights are all reached by inclined planes, cable roads, and in some instances by electric lines. There are six inclined planes, on four of which the electric cars are transferred from one level to the other and continue their course, the planes being provided with triangular shaped trucks with platforms on a level, so that the electric cars are readily run on or off at the terminals. In the Cincinnati electric roads the double trolley is employed, both arms of the circuit being thus more equally balanced than with a track return, and the necessity of tearing up the streets is avoided, while the possibility of destruction of water and gas pipes by electrolytic action is entirely removed. The cars are also provided with electric heaters, and the closed cars have vestibules at the rear end, with an opening at one side. We are indebted for our illustration to the *Street Railway Journal*, New York.



VIADUCT IN EDEN PARK, CINCINNATI, FOR STREET RAILWAY CARS.

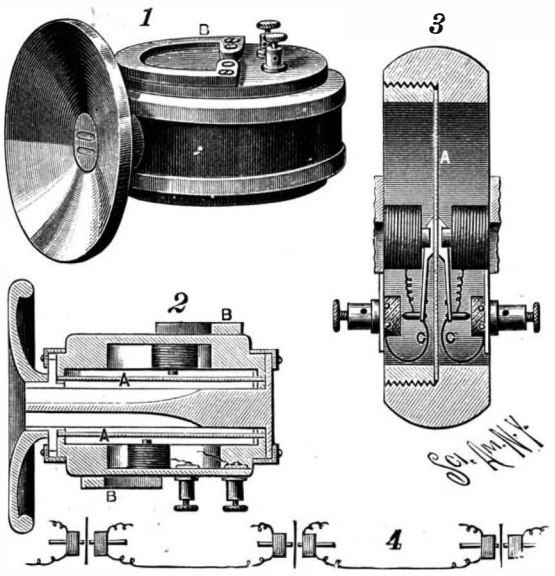
THERE are 10,000 copyrighted volumes of American poetry in the Congressional Library at Washington.

A NEW TELEPHONE.

Mr. Eloy Noriega, the well known electrical inventor of the city of Mexico, has recently patented in Mexico some improvements in telephones, for which greatly improved results are claimed.

The double receiver, shown in perspective in Fig 1 and in section in Fig. 2, is sensitive to weak impulses and gives excellent results with the normal volume of sound and current at the transmitting end of the line.

This instrument has a cell or casing provided with



NORIEGA'S TELEPHONE.

two separate chambers containing diaphragms. The two chambers terminate in an ear piece. Each diaphragm is in the field of a polarized magnet attached to the side of the casing, and the bobbins of the two magnets are connected with the telephone line.

In Fig. 3 is shown in section a double telephone, in which two polarized electro-magnets are supported on opposite sides of the iron diaphragm. The diaphragm carries two arms of insulating material, one on either side of the diaphragm, each provided with a metallic electrode at its free end, which rests on a contact block attached to the binding post. The metallic electrodes are connected with the bobbins, and the arms which support them are connected with delicate curved springs extending to the blocks attached to the binding posts.

This instrument may be used for receiving from separate lines, also for transmitting to two circuits. It may also be arranged for use as a repeater, for repeating from one line to another, as indicated in Fig. 5.

The magnets used in these instruments are made from a new alloy of iron and tungsten, which is more efficient than iron or steel. The inventor claims the efficiency of these magnets ten times greater than that of the ordinary steel magnet.

Maryland Ship Canal.

The construction of a ship canal across the Maryland peninsula between the Delaware and Chesapeake Bays is again being agitated by the citizens of Baltimore, Md., a mass meeting having been held at that city June 25 to devise ways and means of promoting the project. At this meeting a permanent committee of 21 members was appointed to investigate the subject and to report to the city councils. The movement to construct this canal was started many years ago, and in 1878 the federal government appropriated money for making surveys, which were carried out by Major N. H. Hutton. Five routes were surveyed. In 1882 another route was suryeyed by Capt. Thomas Turtle, Corps of Engineers, U. S. Army, which, with an early survey made by Mr. B. H. Latrobe, makes seven separate routes which have been more or less thoroughly surveyed.

Dyeing Leather.

BY J. J. HUMMEL AND H. R. PROCTER.

In applying basic coal tar colors to cotton, it is well known that the latter requires to be mordanted with tannic acid. In the case of leather tanned with sumac and other similar tanning matters, such preparation is of course unnecessary, not only because the leather already contains tannic acid, but because the substance of the leather itself as a protein compound has a natural attraction for the coloring matter. Nevertheless, very poor results are frequently obtained in dyeing leather, *e. g.*, skivers with the basic colors, the colors being pale or irregular. An examination of the dye liquors in these and other cases revealed the fact that the coloring matter was very largely precipitated, due no doubt to tannic acid dissolving off the leather.

Two methods of getting rid of the defect naturally occur to one, viz., to remove the excess of tannic acid present by previously steeping the leather in tepid water, or to render the excess inert by fixing it upon the leather in an insoluble form.

Both methods were tried, with the result that the second proved to be the most reliable and effective. To this end it is merely necessary to work the leather in a tepid bath (45°C.) containing the requisite quantity of tartar emetic for ¼-½ hour, then to wash, before proceeding to the dyeing operation.

By adopting this simple precaution, the dye liquors are maintained in a perfectly clear condition, and since they are invariably unexhausted, they can be used for dyeing further quantities of leather; moreover, the dyed colors are perfectly level, and many shades darker than without this preliminary treatment. The leather itself is in nowise injured, and since the antimony is in a perfectly insoluble form as a tannate, there can be no fear of injurious consequences arising in the ordinary use of such leather.

Dr. Cook's Arctic Expedition.

The steamer Miranda sailed from New York July 7, bearing Dr. Cook's Arctic exploration party. She has been chartered for two months and a half, to take a party to explore the coasts of the frozen North.

There were fifty passengers aboard, most of whom are scientists and sportsmen, a few of whom are going simply for the crisp northern air. The scientific men will make researches along the coasts of Labrador and Greenland, and the sportsmen will shoot polar bears and reindeer.

The Miranda will stop at points in Nova Scotia and Cape Breton, cruise around Newfoundland, cross Davis' Strait to the west coast of Greenland, where some of the party will remain to explore the fjords and to examine the fossil beds, the Norse ruins and the other things of interest to scientists.

The Miranda will enter Melville Bay later and go to the headquarters of Lieutenant Peary, and perhaps the sites of the winter quarters of Kane, Greely and Hayes will be visited. The return will be along the coast of Greenland and Labrador to New York, where it is expected the vessel will arrive on September 15.

Among the party were William H. Brewer, professor of agriculture, Yale University; C. Fred Wright, of Oberlin College; Professor B. C. Jillson, Professor G. W. Dove, of Andover; L. L. Dysche, professor of zoology, Kansas State University; Professor Charles E. Hite, of the University of Pennsylvania; Professor Elias B. Lyon, of Chicago; and Professor A. A. Freeman, of Andover.

THE Bhatgur reservoir, a great artificial lake in India, said to hold about 4,641,000,000 cubic feet of water, acts as a feeder to the Nira Canal. It is formed by a masonry dam 103 feet high and 3,020 feet long.

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Correspondence.

To the Editor of the Scientific American:

In one of the late issues of the SCIENTIFIC AMERICAN there appeared an article concerning the Wimshurst electrical machine without sectors. I have constructed such a machine, the diameter of the plates being 23½ inches. I have found that, after starting the machine, the "neutralizing brushes" may be removed an inch or more from the plates without decreasing the effectiveness of the machine.

This may be known to others, yet I have never heard or read of it, and I think it would be valuable, since it decreases the strain of the plates and reduces the labor of running the machine. JOHN HERTNER.

Dayton, O.

Chemically Preserving Potatoes.

In a paper on this subject M. Schribaux states that, from the numerous experiments made on the best method of preserving potatoes, it has been established that any action should not be on the skin of the tuber, but rather on the tuber itself. I have proved, says M. Schribaux, that by radically destroying the shoots when more or less developed, the potato retains all its qualities at least till the time when the next year's growth has become abundant in the market.

Where the number of potatoes to be dealt with is small it is sufficient to remove the eyes, or the shoots, with the point of a knife, or better still with a steel penholder in which a steel pen has been placed with the point turned inward; this will be found to act in the manner of a gouge. By inserting this for rather more than a tenth of an inch into the potato, the eye is easily removed. I have in the laboratory potatoes of the year 1891 which have shriveled owing to evaporation, but of which the substance is firm, and has not sensibly deteriorated. A singular circumstance is that they have become sweet, and contain a sugar which differs in no way from cane or beet sugar.

It may be said that the process is slow, but I find that an unskilled laborer was, in a working day of 10 hours, easily able to deal with 300 lb. of potatoes. Cooking potatoes, which have a small number of eyes, can, of course, be easier dealt with. If a large quantity have to be treated a chemical process must be resorted to, in order to destroy the shoots.

The tubers then are immersed for a space of from 10 to 12 hours in water containing from one to two per cent of ordinary sulphuric acid. The potatoes must afterward be dried and put in a cool and well-aired place. The acid solution should be placed in a receptacle of wood.

The solution keeps good for a long time if the tubers are carefully cleaned so that no earth adheres to them before being put into it.

The acid acts in the following way: It eats in for about a tenth of an inch in the region around the eyes where the skin is tender, while it does not affect the rest and thicker part of the skin. About the eyes it will be found that an incrustation has formed, which completely blocks them up.

The following remarks are to be noted: It is useless to treat any but sound potatoes in this way, as the treatment does not stop disease, but merely keeps the sound potatoes wholesome. The potatoes should be carefully cleared from earth before being put into the solution, as earth adhering checks the action of the acid. It is well before treating any large quantity of potatoes to experiment on a few as follows: Take three dishes of glazed earthernware and fill them with solutions containing respectively 1 per cent of the acid, 1½ per cent and 2 per cent. Then immerse half a dozen potatoes and leave them in for from 10 to 12 hours. After that take them out and dry them, and after three days' interval examine them by cutting into the eyes to see whether these have been destroyed. The external aspect of the potato will, moreover, show whether the action of the acid has been too great on the skin, and the proper strength of the solution to be used on the particular class of potato to be dealt with will by this means have been arrived at. The skins of some potatoes, it should be observed, are much coarser than those of others, and the solution requires to be regulated accordingly.

Transfusion of Blood in Its Legal Aspects.

A gentleman named Lefevre being sick unto death, transfusion of blood was had recourse to, and the patient's gardener volunteered to supply the vital fluid. The offer was accepted. Some time afterward the gardener fell ill in his turn, and the worthy delver attributing his illness to his act of generosity toward his master, claimed 60,000 francs damages. Three experts were appointed to examine and report on the case, but before the report was forthcoming the man died. His widow continued the action, and the Civil Tribunal of the Seine has delivered judgment in favor of the defendant. A *post-mortem* examination of the gardener's body had revealed as the cause of death cancer of stomach. The court held that even had the transfusion lessened the powers of resistance of the man to the ravages of the disease that caused his death, the fact of his having voluntarily offered his blood for the benefit of his master absolved the latter from any financial responsibility that might be urged against him.—*Lancet.*

Steam Consumption of Locomotives.

In the *Revue Generale des Chemins de Fer* M. Desdouits gives the results of a number of experiments on the steam consumption of locomotives per indicated horse power per hour. Experiments made in France in 1867 showed that at that time express engines used on test 36·38 pounds of water per indicated horse power per hour, and goods engines 33·07 pounds. It is stated, however, that the priming water amounted to 30 per cent, which, if correct, reduces the true consumption of steam to about 26·5 pounds per indicated horse power per hour. In 1882, a locomotive tested on heavy inclines on the Lyons Railway used 27·44 pounds of water per indicated horse power, the priming being 9 per cent; this figure corresponds to about 25·5 pounds net. The cut-off was at about 30 per cent of the stroke. In 1893 an elaborate series of tests were made on the French State Railways. The engines used were four coupled, the wheels being 6 feet 6¾ inches in diameter, and the cylinders 17·27 inches in diameter by 25·6 inches stroke.

The clearance at each end was 5 per cent of the piston displacement. The working pressure varied from 128 pounds to 142 pounds per square inch. The engines were first tested on the regular express service between Versailles and Chartres, a distance of 43·7 miles. The speed ranged from 37·2 to 40·3 miles per hour on five different trips, and the average consumption of water amounted to 25·61 pounds per indicated horse power per hour. It was slightly greater at the lower speeds, and slightly less at the higher ones. On another occasion one of these engines was run by a driver who preferred to throttle the steam instead of linking up, and the engine then used 29·1 pounds of steam per indicated horse power, while on the same trip made with the regulator wide open and the speed governed by linking up, the steam consumption fell to 24·37 pounds per indicated horse power per hour. By giving the valve negative inside lap, this consumption was further reduced to 23·96 pounds. M. Desdouits considers the experiments to show that with simple engines the best results are obtained with a working pressure of about 142 pounds per square inch, with a cut-off at one-fifth the stroke, and the valves designed so as to give negative inside lap.

Spontaneous Combustion of Sodium Peroxide and Aluminum.

Sodium peroxide (Na_2O_2) is for many purposes an admirable oxidizing agent, which, however, must be used carefully, as Victor Meyer has already shown.

The authors use it in aqueous solution to oxidize the residues they have obtained when making phosphorus by the action of aluminum upon the phosphates. It acts on these residues vigorously, but not dangerously.

The reaction is quite different when aluminum powder and sodium peroxide are mixed together. When this mixture is exposed to the air for a short time, the moisture that is absorbed by the sodium peroxide suffices to set up a spontaneous combustion. This may likewise be induced at once by the addition of a few drops of water, and is accompanied by the production of a very high temperature. This mixture must, therefore, be regarded as highly dangerous, and should be used with caution.—*A. Rossel and L. Frank.*

The Trolley.

"There is no use in our trying to compete with the trolley lines," said a railroad man the other day, to a reporter of the *Philadelphia Record*, as he glanced ruefully over some figures, which showed a decrease of $40 a day in his company's receipts from suburban travel on a branch line since the opening of a trolley road. "We have to give too much to our patrons," he continued. "We provide handsome terminals, fine suburban stations, heat, water, light and a seat for every passenger, while the trolley lines furnish almost nothing but transportation. They furnish no stations; crowd the passengers in, so that many have no seat, and in that way manage to make money. We can't do things that way, and so I see no money for us in trying to compete with the trolleys. Of course, they can't touch us on long distance traveling, but in the near future I expect to see them absorb a large amount of our suburban travel."

Ammonium Nitrate.

On mixing solutions of sodium nitrate and ammonium sulphate and refrigerating, most of the sodium sulphate formed separates out; the remainder is treated with nitric acid, whereby sodium nitrate and sulphuric acid are formed, so that by repeated coolings ammonium nitrate separates. The mother liquors are neutralized with soda and used over again to dissolve sodium nitrate and ammonium sulphate.—*Fr. Benker, Clichy.*

Fireproofing Compounds.

The systematic testing of about fifty different substances for their capacity of rendering materials uninflammable showed that the compounds recommended for this purpose are of very unequal value. Thus, by holding in the flame of a candle strips of filtering paper uniformly impregnated with solutions of the various bodies containing 20, 15, 10, 5, 3·5, 2, 1, and 0·5 per cent of anhydrous substance, or charged with an insoluble body precipitated from such solutions, it was found that, while some were rendered practically uninflammable, others did not appear to be much affected by the impregnation, or had become even more combustible than pure paper. In accordance with the results of a great number of such experiments, the substances employed are classified as follows:

1. *Substances Increasing Combustibility.*—Sodium sulphate, sodium sulphite, sodium thiosulphate, sodium silicate, sodium carbonate, sodium stannate, sodium tungstate, sodium chloride, potassium sulphate, potassium phosphate, potassium chloride, zinc carbonate, calcium carbonate, magnesium carbonate, calcium sulphate, ferrous sulphate, magnesium hydroxide.

2. *Indifferent Substances, or Bodies which are Effective Only When Used in Large Quantities.*—Magnesium sulphate, aluminum borate, zinc borate, calcium phosphate, magnesium phosphate, aluminum phosphate, zinc phosphate, sodium acetate, potassium acetate, silicic acid, sodium phosphate, aluminum hydroxide precipitated from an acid solution, tungstic acid, ammonium tungstate, potassium carbonate.

3. *Substances which Render Cellulose Specifically Uninflammable.*—Ammonium sulphate, ammonium phosphate, ammonium chloride, calcium chloride, magnesium chloride, zinc chloride, zinc sulphate, stannous chloride, alum, borax, boric acid, aluminum hydroxide precipitated from sodium aluminate.

The lowest strengths of solution and the least quantity of substance (anhydrous) necessary for rendering 100 parts of cellulose uninflammable are given in the following table. The figures to be taken as approximate only.

Name of Substance.	Lowest Percentage of Substance in Solution necessary to render Cellulose Uninflammable.	Least Quantity of Substance required for rendering Uninflammable 100 parts of Cellulose.
Ammonium chloride	1·5	1·2
" phosphate	1·5	4·5
" sulphate	1·5	4·5
Zinc chloride	1·5	4·0
Calcium chloride	1·5	4·5
Magnesium chloride	1·5	4·5
Aluminum hydroxide	1·5	3·8
Alum	2·0	..
Zinc sulphate	1·5	4·5
Stannous chloride	2·5	..
Borax	1·5	8·5
Boric acid	2·5	10·0
Potassium carbonate	7·5	..
Magnesium sulphate	7·5	15·0
Sodium chloride	15·0	35·0
" silicate	17·5	50·0
Silicic acid	12·5	30·0
Potassium chloride	20·0	45·0
Sodium phosphate	7·5	30·0
Potassium "	20·0	..
Aluminum borate	12·5	24·0
" phosphate	10·0	30·0
Calcium "	12·5	30·0
Magnesium "	12·5	30·0
Zinc borate	7·5	20·0
" phosphate	Above 15	..
Tungstic acid	" 10	Above 15
Sodium tungstate	" 10	" 15
Ammonium "	7·5	" 10
Clay (air-dried)	..	75·0
Sodium and potassium acetates	7·5—5·0	..

Of these substances, the three first mentioned ammonium salts and aluminum hydroxide may be considered to be the best adapted for practical purposes. The explanation of the fireproofing properties of the ammonium salts is to be found in their becoming volatilized and dissociated by the influence of heat, the vapors formed producing an uncombustible mixture with the combustible gases. Calcium, magnesium, and zinc chlorides act in a similar manner through the separation of hydrochloric acid. Sodium and potassium chlorides being unalterable by heat are also ineffective as fireproofing materials. Zinc sulphate and alum likewise owe their effectiveness to dissociation by heat. The action of aluminum hydroxide is a purely mechanical one, hence the striking difference in the behavior of the granular modification left after drying of the voluminous precipitate from an aluminum salt and that of the exceedingly finely divided product obtained by the action of carbonic acid upon a solution of sodium aluminate.

As regards the increased combustibility of paper after impregnation with the substances enumerated above, this appears likewise to be owing to a mechanical aetion, resulting in the prevention of loss of heat.

For practical use the following strengths of solutions are recommended:

10 to 15 per cent for textile fabrics, stage decorations, etc.

20 to 30 per cent for pasteboard, thin boards, etc.

25 to 30 per cent, applied twice or three times, for heavy timber, thick boards, etc.

As an addition to the water used for extinguishing fires, calcium or magnesium chlorides might be useful. —*P. Lochtin, Dingler's Polyt. J., 290, 230–235.*

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Oleomargarine and Vegetable Lard.

BY H. W. WILEY.

As a distinction between a pure and an adulterated article, take the cases of butter and oleomargarine. Pure butter for instance must be clean, sweet, wholesome, and made of the fat of cow's milk, and must contain only a certain proportion of water, curd and salt. Oleomargarine may be as sweet, clean and wholesome as the butter mentioned above, yet when sold as butter it is clearly not pure food, but a spurious article.

Again, when the housewife buys lard it is supposed that the article she obtains has been made from the fat of healthy, freshly slaughtered hogs, carefully selected and cleaned and rendered in clean kettles or tanks. Cotton seed oil and beef tallow, in respect of cleanliness, nutritive properties and wholesomeness may equal and even excel pure lard, but the admixture of these articles with hog's lard, or their sale as such, without the knowledge of consumers, is clearly a fraud and an adulteration.

Butter.—In regard to butter, the character of adulteration is well known. The use of oleomargarine as a butter substitute has been practiced for many years. The oleomargarine law, which imposes a tax of two cents a pound on the manufactured product, has not helped to restrict its use, but has rather increased it, by giving to the consumer a guarantee of purity. The amount of tax collected on manufactured oleomargarine for the fiscal year ending June 30, 1892, was $945,675, which shows that there were 47,283,750 pounds of oleomargarine manufactured in the United States in twelve months.

The number of retail dealers in oleomargarine increased during the year more than 22 per cent over the preceding year. The amount of tax paid by retail dealers for the fiscal year ending June 30, 1891, was $146,293.70, and for the fiscal year ending June 30, 1892, $204,215.

The increase in the number of wholesale dealers was nearly 100 per cent. The amount of tax paid by wholesale dealers for the fiscal year ending June 30, 1891, was $53,191, and for the fiscal year ending June 30, 1892, $106,036.

There can be no reasonable objection to the use of oleomargarine; it is clean, wholesome and digestible. When it is to be kept for a long time before use, as on shipboard or in distant mining camps, it is preferable to butter, because it has but little tendency to become rancid.

Lard.—For similar reasons there can be no possible objection to the use of cotton seed oil as a substitute for lard or when mixed with lard, provided it be sold for what it is. Most of you are familiar with the great fight which was made against the use of the term "pure refined lard," which was the trade name of a mixture of lard stearine with cotton seed oil. "Pure refined lard," it was claimed, was a term which had been used so long to designate the mixed product that it had become in reality a trade mark, and was, therefore, entitled to respect and protection. In the investigation which was held before the Congressional committees, it appeared that as to the trade the contention was quite justifiable. Goods sold under that name were understood to be mixed. When, however, the mixed product was offered to the consumer, it was purchased with the idea which the name naturally implied, that an extra fine quality of hog's lard was secured.

All attempts to pass a pure lard bill, modeled on the oleomargarine act, have heretofore failed in Congress, but several of the States have prohibited the sale of mixed lard, except when offered under the proper name. Manufacturers have, therefore, been gradually forced to abandon the term "refined lard" when applied to this commodity.

I am of the opinion that many persons would prefer a cooking fat largely of vegetable origin to a pure animal product. To me, it seems that some State legislatures have taken a reprehensible course in prohibiting the sale of vegetable oils as a substitute for lard for cooking. The grower of hogs undoubtedly has a right to contend against the sale of vegetable oils as hog fat, but when he pushes his claim still further, and demands that the markets be closed to products as pure and nutritious as his own, he passes beyond the bounds of public support. Every person in the United States who prefers cotton oil to lard should be allowed to purchase his supplies without let or hindrance. Every grower and maker of pure lard has the right to an equally open market from which every adulterated and mixed lard offered as pure should be rigidly excluded.

For a time, a few years ago, when a popular fad prevailed in favor of nitrogenous foods, the true value of fats to the digestive and nutritive economy was not well appreciated. At the present day this is all changed, and we know how to value a fat properly.

It is, therefore, a matter of no mean importance to protect the public in the use of olive oil instead of cotton oil, of cotton oil instead of lard, and lard instead of a mixture of beef and cotton oil stearine. It is true that cotton oil, when carefully refined, is almost as good a salad dressing as olive oil, but is very much cheaper, and those who prefer to pay the high price should be secured against fraud. In respect of wholesomeness and digestibility, it would be hard to choose wisely between the two.

One of the great difficulties in securing the enactment of a national pure food bill has been the feeling in cotton-growing regions that such a bill would restrict the market for cotton oil. This is true, if the fraudulent market is meant. By that I mean the serreptitious sale of cotton oil as olive oil and as lard. But such a bill would not interfere in the least with the legitimate market for the product. Cotton oil as a food has such merit of its own as to warrant the belief that it does not require any smuggling to secure for it a wide and rapidily increasing use. The South as well as the North would be the gainer from honest markets for honest foods, and it is a shortsighted policy that leads to a crusade against such legislation as will secure the desired result. It would be a rather unfortunate thing for the whole country should an irrepressible conflict between the *sus* and the *gossypium* keep our interstate market forever open to mixed or doubtable fats.

* rom a lecture delivered before the Franklin Institute by H. W. Wiley, Chemist of the U. S. Department of Agriculture.

The Preparation of Wool Stock and Breaker Carding.

So much has been written on these two processes that, to those who really appreciate their importance and shape their practice accordingly, it must seem that to say anything in addition to what has already been expressed is but a waste of words. A visit, however, to many of the smaller woolen mills, and some of the larger ones as well, will prove that there is still a wide field for missionary work. The theory and practice still prevails that any one, no matter how incompetent, is generally good enough for a picker tender. If there is nothing else in the world that such a person is capable of doing, he can at least tend the picker well enough. Any old shed, to follow out this theory and practice, too, is good enough for a picker house, if it is only sufficiently disconnected from the main buildings to meet the insurance requirements. This is chiefly the only end a picker house is expected to fulfill. It makes no matter how rough it is, or how open at the top, sides, or floor. The little matter of wool that it takes to cover the roughness is of no consequence, as the cost of wool to be wasted is of no account when it is to be wasted by the employer. It is when the carder wishes a little more to help out his poor stock that he is given to understand how expensive it is. The machines and belts of the room may get watersoaked in every storm. But what of it? They are nothing but picking machines. They simply blow the stock through. There is no roving, or yarn, or thread to keep up, as in the case of the cards, mules, or looms; and as for the belts, the carder's time that may be spent in repairing them, although much needed elsewhere, is of no consequence. It makes no difference if the rain does ruin them. At least it so appears until the time comes when they must be replaced by new ones, and then there is a loud complaint that they have been so quickly destroyed. Proprietors and managers are not altogether blamable for the existence of such a state of things. They are often the effects of the carder's indifference and carelessness in regard to what is really one of the most important branches of his business.

The picker house should be just as carefully constructed and its appointments just as perfect as the card room. These things are essential in order that the stock may go to the latter room in good working condition. If a certain degree of warmth and moisture are requisite for the proper working of the wool, it is in the picker room that it must receive it, and every precaution should be taken to keep it both warm and moist. How can this be done in a room which is an oven in hot weather, a swimming pool in wet weather, and a refrigerator in winter? Nothing but a thick walled brick building, with high and smooth ceilings, is fit for the picking or storage of stock. If the inside partitions of the compartments are of the same material, they will be all the better. Then with a card room of similar construction, filled with and containing only carding machinery, a carder will have some chance of getting his stock worked up while it is in a suitable condition; that is, if he has seen that it has first been properly prepared.

Almost if not quite as long as the carding machine has been used, it has been the practice with more or less care to lay down the different kinds or colors of stock in layers, one upon another, until all the stock intended for the lot or batch was built up in a single pile. This heap is then broken down at the sides as it is fed to the mixer, so that as much as is possible of all the different kinds or colors may be fed to it at the same time. After this long practice, and after all that has been said and written about doing this carefully and thoroughly, one would hardly expect to find all these precautions neglected in a modern establishment. Within a short time, however, the writer visited a mill and found it to be the practice in the picker room to let a fourteen year old boy take one kind of stock from a bag here, another from a bale there, and so on, using his own judgment as to how much of each he put into the mixture before changing to another. No one who knows anything about picking need be told that the resulting product of this operation was not as uniform as a well laid batch of stock is before it goes through the mixer. And yet the manager of this establishment had the greatest confidence that all the imperfections resulting from this lack of system would be made all right by the sixty doublings on the second breakers. These doublings are regarded as a sure and never failing corrective for all defects in the preliminary processes. In this very case they were expected to even up such bungling work as we have noted in the picker room. They are also expected to overcome the bad work from half cleaned, worn out cards, with slipping gears, as well as the imperfect work from dirty, neglected and dilapidated feeders.

In a recent article in this series something was said concerning the impossibility of getting coarse and fine drawings into a creel so as to make even drawing from the card to which they were fed. The unevenness must be slight and come with some degree of regularity to be corrected in this manner. Again, they must be used by the second card as fast as they are made by the first. In the room of which we have spoken there would be at times two or three creels full of drawings on the floor, so placed and used that there was a creel full in separate piles. Many of these piles were so nearly all coarse or all fine as to make a decidedly injurious change in the roving as each one was used.

But suppose this second breaker doubling was such a universal remedy from all previous unevenness, there is something to be said against the abuse of the stock and the first breaker, as well as the second card.

"Stock well mixed is half carded" is an aphorism among old carders. If this claim is too broad, it is certainly not too much to maintain that stock well cleaned, mixed, and picked is half broken, so far as the first breaker is concerned. If the stock is a mixture of long and short stapled wools, and it is so imperfectly mixed that the long fibers are fed separately to the card, then it is working harder than at other times. The same result will follow when light and heavy stock is fed to the scale pan in like manner, and if one portion of such half-mixed stock is what is called a "carrying stock," while the other is such as requires better stock to carry it through, then the card will at times make more flyings, which must be reworked at another loss, which of course affects the profit side of the balance sheet. Again, any one can see that there are greater chances for breakdowns and more clean waste and consequent loss of production than if the stock, whether good or poor, be thoroughly worked together before it reaches the card at all.

If the second breaker gets perfectly even drawings, it does not require any argument to prove that it will do better carding than if it has at one time to take drawings that are needlessly large, while at others the feed is so very light that, but for the bolstering it gets from the heavier, it would be absolutely useless. Nor will drawing so made, although it may have evenness in weight, yard for yard, give such smooth roving as that which gets its evenness and smoothness from the first card, other conditions being equal.—*Industrial Record.*

Improved Method of Manufacturing Hydraulic Cement.

In order to render the usual preliminary crushing of cement clinker in stone breakers unnecessary, the patentee adds 5 to 30 parts of granulated blast furnace slag to 100 parts of the ordinary raw materials for the manufacture of hydraulic cement, and burns the mixture in the ordinary way, obtaining a product which is granular and brittle and can be fed direct to the grinding machinery without passage through a stone breaker. By the use of a larger proportion of slag, *e. g.*, 30 to 125 parts to 100 of cement raw materials, and modifying the process of burning, a product can be obtained similar to hydraulic lime or Roman cement, or Portland cement.—*G. W. A. Stein, Wetzlar, Germany.*

Mount Logan, the Highest Peak in North America.

The last number of the *Bulletin* of the American Geographical Society announces that the recent study of the observations on mountain summits in the neighborhood of Mount St. Elias shows that Mount Logan is the loftiest peak in North America, with a height of 19,500 feet, thus being 1,200 feet higher than Orizaba and 1,500 feet higher than Mount St. Elias.

Waterproofing for the Soles of Shoes.

The compound is applied over the welt and insole, or over the seams, joints, peg holes, etc. Two and one-half pounds of wax are melted and three pounds of powdered talc, steatite, or soapstone are mixed therewith; four pints of rubber paste or caoutchouc (Brazilian gum) are then incorporated with the mass.—*E. H. Lewis.*

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A STEAM ICE CREAM MANUFACTORY.

The ice cream now in general use is manufactured from a combination of milk, pure cream and gelatine, flavored with different extracts, such as vanilla, lemon, strawberry, etc., the ingredients being first mixed up together and placed in circular metal vessels or runners which revolve around inside of circular wooden tubs, the runners being surrounded by a quantity of cracked ice and rock salt. Each runner is furnished with a beater having a number of blades which revolve around on the inside, beating up the material, the ice and rock salt causing it to thicken and form itself into ice cream. Some manufacturers use eggs, corn starch, etc., and boil the ingredients before freezing. The first process is the mixing together of the ingredients. About 10 quarts of pure cream, 10 quarts of milk, and about 8 pounds of sugar (granulated) are first mixed together. If the ice cream is to be flavored with strawberry, about 6 to 8 drops of pure red coloring and ¼ pint of essence of strawberry is added. A quantity of gelatine dissolved in about a quart of warm water is then added to this, bringing the solution up to about 24 quarts in bulk. It is then run through a strainer or fine sieve into the runner. The runners are made of copper, the inside of which is coated with tin, which, after about four weeks' constant running, has to be renewed, the coating of tin being worn off by the working of the beater. The runners are about 23 inches in height and about one foot in diameter, and hold about 40 quarts. The wooden tubs in which they revolve are 2 feet 4 inches in height and are about 20 inches in diameter on the inside, leaving a space of about 4 inches for the ice around the runner. Attached to the top of the cover of the runner and perpendicular shaft of the beater, which revolves in a socket at the top of the grinding machine, are two gearing wheels, which are geared to another attached to the shafting of the machine. When the machine is in motion the beater, containing ten 1½ inch iron blades, and the runner revolve around in different directions, making about 55 revolutions per minute. As soon as the machine is set in motion, a small quantity of ice and rock salt is added, which is renewed every few moments until the tub is filled, taking in all about 25 pounds of ice. The beating operation takes about 12 minutes, the salt and ice gradually freezing the 24 quarts solution, while the gelatine swells or raises the material up to 40 quarts. The grinding operation is completed when the ice cream shows or adheres to the glass windows in the cover of the runner. The wooden tub with the runner of cream is then rolled one side and another is put in its place to pass through the same operation. The ice cream is then taken from the runners and put into cans ranging from 1 to 10 gallons each, and packed into ice and rock salt for delivery, which is ready in about two or three hours' time.

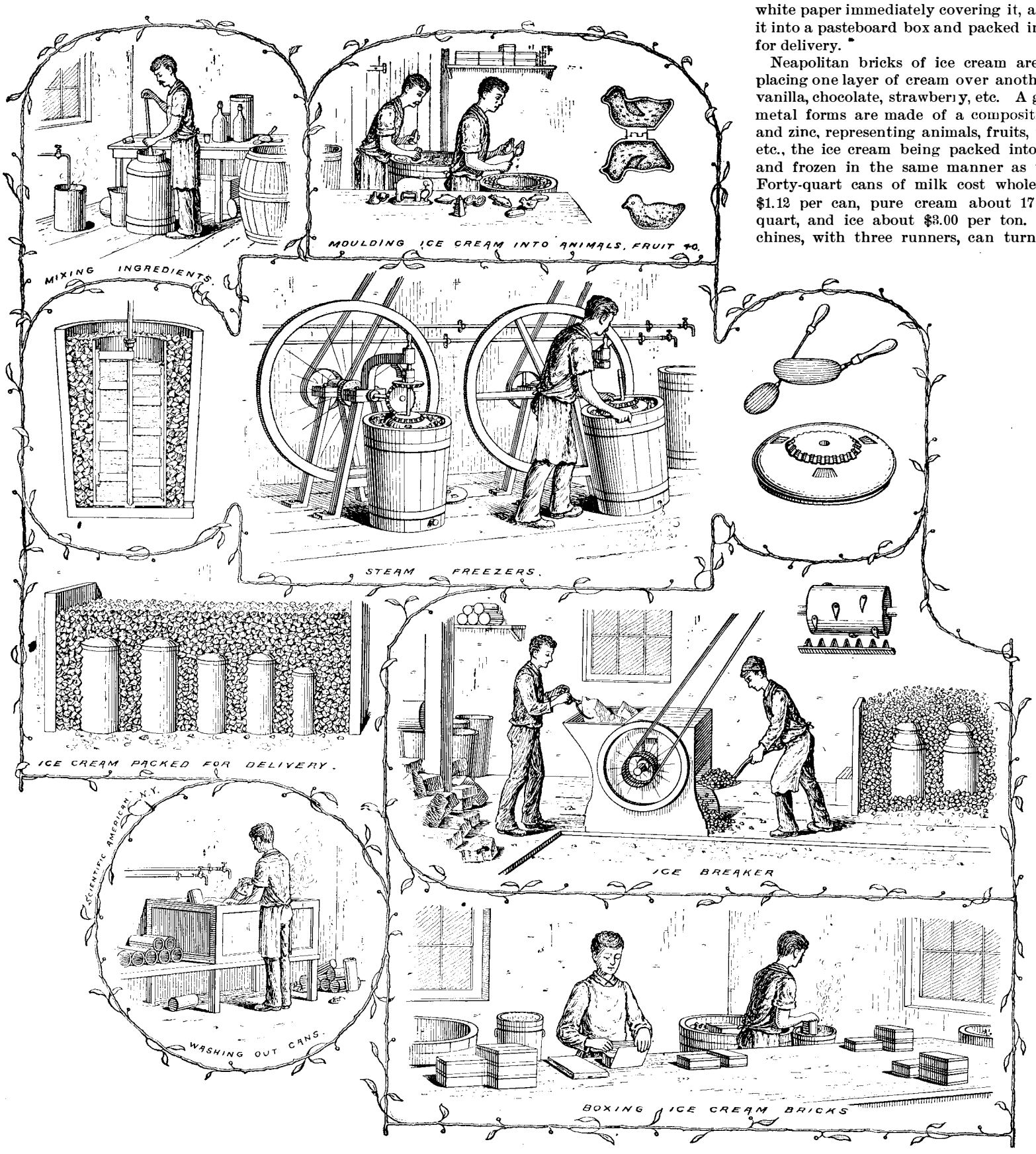
Chocolate ice cream is made by dissolving about 1¼ pounds of chocolate cakes in about one quart of hot water, which is added to the milk and cream in the same manner.

For vanilla flavoring about ½ pint of the extract is used for a can containing 40 quarts of ice cream.

The machine for breaking up ice consists of a revolving cylinder 14 inches in diameter and 20 inches in length, riveted to which are 9 conical shaped wrought iron teeth about 5 inches in length, which, when the machine is in motion, pass between a number of other teeth connected to the frame-work of the machine. The cakes of ice, which weigh about 50 pounds each, are first broken into two pieces and placed in the machine. The teeth of the revolving cylinder, which makes about 120 revolutions per minute, crash through the ice, breaking it up into small pieces at the rate of a ton in every twenty minutes.

Ice cream bricks are made by packing the cream into metal forms. These forms have a top and bottom cover. The ice cream is first put into these brick-shaped forms and a strip of paper placed between the cream and each cover, which holds them firmly in place, and then they are packed away in salt and ice and frozen for about three hours. They are then taken out and the forms dipped into a pail of warm water, which loosens the cream from the sides. The top and bottom covers, after being wiped with a cloth, are then taken off, the attendant allowing the loosened brick of cream to slip out of the form on to a strip of white paper immediately covering it, and placing it into a pasteboard box and packed in ice again for delivery.

Neapolitan bricks of ice cream are made by placing one layer of cream over another, such as vanilla, chocolate, strawberry, etc. A great many metal forms are made of a composition of lead and zinc, representing animals, fruits, vegetables, etc., the ice cream being packed into the forms and frozen in the same manner as the bricks. Forty-quart cans of milk cost wholesale about $1.12 per can, pure cream about 17 cents per quart, and ice about $3.00 per ton. Two machines, with three runners, can turn out from 1,500 to 2,000 quarts of ice cream per day. The sketches were taken from the plant of George Schmid, Jersey City, N. J.



A STEAM ICE CREAM MANUFACTORY.

Improvement in Beer.

This relates to the application of a preparation of the fruit of the carob tree (*Ceratonia siliqua*) in brewing, with the object of imparting a pleasant aroma and giving greater body to beer; also to mask the vapid, bitter flavor and render the beer better fitted for keeping and more wholesome. The fruits are treated with warm water, and are washed and dried at about 30° C. until they present a brownish color, and the juice of the fruit when the latter is broken is dark red. The dried fruits while still warm are cut into pieces and may be stored or added directly to the mash in the proportion of about 2·5 kilos to a hectoliter of ordinary beer.—*J. Pikhart, Mahrisch Schoenberg, Moravia.*

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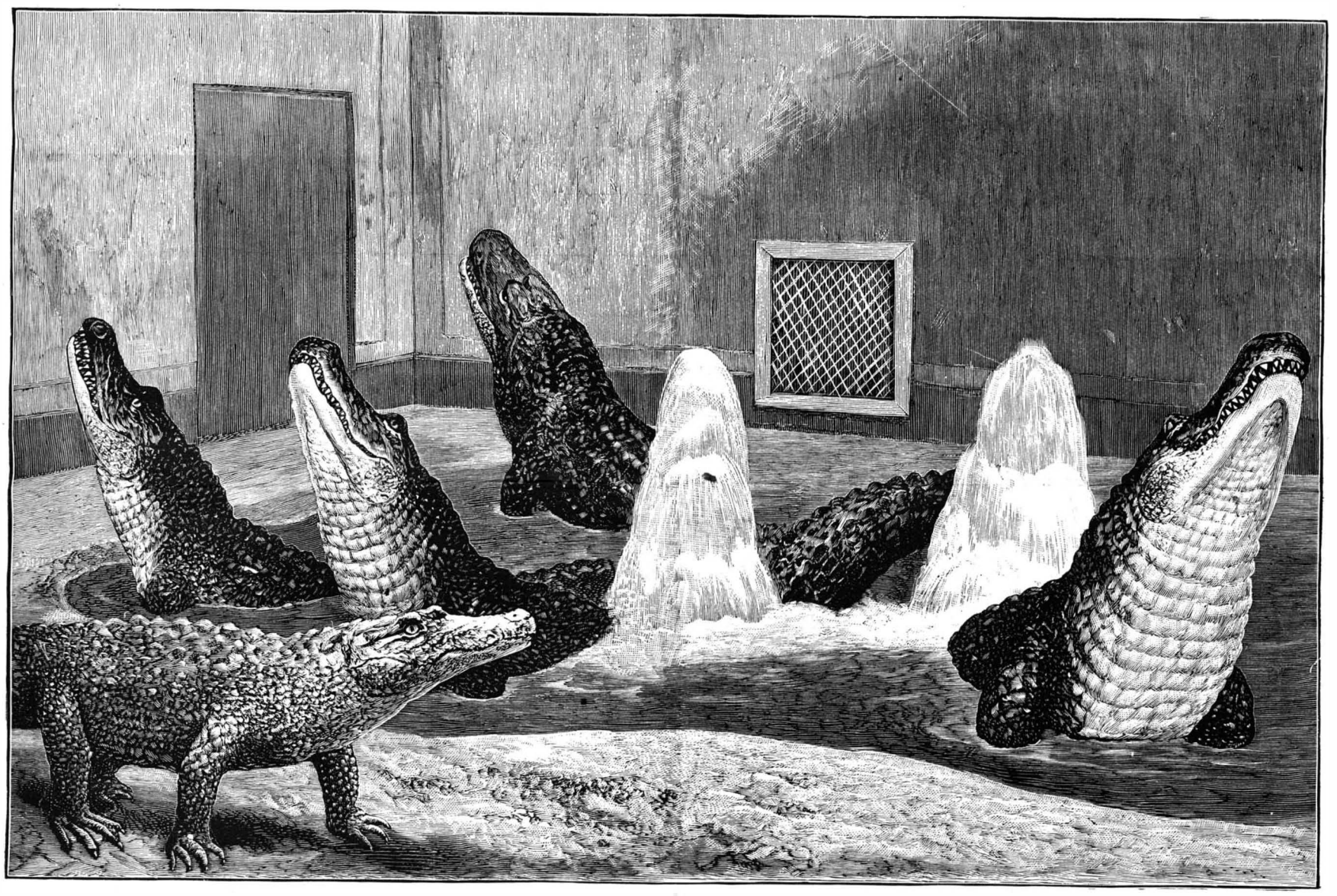
ROARING ALLIGATORS IN THE ZOOLOGICAL GARDENS AT HAMBURG.

It is a dull, lazy company that one finds in that part of the reptile gallery devoted to crocodiles in the Hamburg Zoological Gardens. A lady once told the writer of these lines that he might as well have wooden models of crocodiles in the water, and they would answer the same purpose as the living animals; and in fact, a wooden block cannot lie more quietly than a crocodile, which will not move from one spot for hours, often for a whole day. When we watch these creatures, it is easy to understand the stories told by travelers about the crocodiles and alligators lying on the sand-banks of the rivers in the tropics, as still as trunks of trees. The lazy creatures move about only on rare occasions; when there is food, when they are disturbed by the cleaning of their cage, and—when they roar.

But let us first learn what conditions are necessary to make captivity endurable to an alligator. For his welfare, he needs, first of all, water; and if the temperature of his bath is from 68° to 75° F., he certainly will not leave it unless obliged to do so; he will lie there for a long time with only the top of his head above water, so that his nostrils are free for breathing purposes; he can see all about him, and the slit-like ears (which can be closed to exclude the water) are also above the water. They can be studied best when from his hand; but the uncouth fellows are not very careful, and if the keeper were not on the watch, his hand might be taken with the food. They are fed only twice a week, and their slow digestion corresponds with the lazy nature of these reptiles. Nevertheless, and perhaps for this reason, it is perfect. On the whole, they are well fed, and the quiet life of captivity suits them admirably. The oldest of these creatures, an alligator from the Mississippi River, has already been in the Hamburg Gardens, fourteen and a half years. When he was brought he was only 2 feet long; now he measures 8 feet 6 inches, being one of the largest of the company.

Large crocodiles look so malicious, and are so dangerous when free, that the keeper does not handle our reptiles even when cleaning the cage and tank; the crocodiles are very peaceful among themselves, and only once in a while is there a bloody fight; wounds received at such times heal quickly and easily.

The artist has represented a very peculiar and unusual occurrence in the life of our captives. These creatures, which are usually so phlegmatic, are evidently greatly excited—they are roaring. And the cause? In cleaning the neighboring cages the keeper has closed the windows suddenly, and it seems that the alligators are nervous; the unusual slamming noise disturbed them; they became attentive, then one after



ROARING ALLIGATORS IN THE ZOOLOGICAL GARDENS AT HAMBURG.

in this position. The large alligators and Nile crocodiles that share their captivity with them are very similar; a learned zoologist tells us that the chief difference between the alligator of the New World, or the cayman, and the crocodile of the Old World lies in the formation of the mouth.

The canine tooth in the lower jaw of a true crocodile passes into a notch or furrow in the upper jaw, while that of the alligator passes into a cavity or pit in the upper jaw. We have also noticed that the snout of the Nile crocodile diminishes toward the front, while that of the Mississippi alligator, or cayman, broadens and is rounded, not unlike the snout of the pike when looked at from above; and for this reason it has been called the pike crocodile. All crocodiles, without exception, are provided with the well-known armor, and the scales on the tail stand upright like a comb. The tail is flattened at the sides and answers for a rudder.

While we are diligently studying the exterior of our reptiles, the lazy company suddenly begins to show signs of life. The keeper is approaching with the food basket; all eyes are turned toward the door of the cage, every movement of the attendant is closely watched, and the fish, dead rats, ducks and young rabbits which he throws to the alligators and crocodiles are skillfully caught. The boldest of these come close to the keeper, who remains outside of the door, and take the food the other raised itself, and then there was a roar. In doing this the animals drew a deep breath and sent forth a powerful bellow, their flanks moving in and out so rapidly that the water on both sides of them was forced up in jets. This moment was seized by the artist.

The alligators are making all the noise during this unusual excitement, the Nile crocodiles being quiet, simply because they are kept out of the water by their larger and consequently stronger relatives, of whom they are afraid. The Nile crocodile is the only one that has been heard to roar when free, and neither crocodiles nor alligators have ever before been known to roar in captivity.—*Dr. Heinrich Bolau, in Illustrirte Zeitung.*

Zinc Plates as Substitutes for Lithographic Stones.

The zinc plates, as pure as can be obtained commercially, are passed through highly polished cold rollers to remove any surface marks. They are then placed in dilute nitric acid (1 part acid to 100 parts water). This brings to the surface of the zinc a blackish mass containing impurities, which is removed by washing with water and scouring with pumice powder. This is repeated until the nitric acid and water no longer produces any appreciable amount of the blackish mass. Such treatment renders the plates absorptive and removes all matters deleterious to lithography. They are then dried and subjected to the sandblast process to produce a grained surface. When this has been done they are placed in a bath composed of 4 parts of nitric acid, 1 part of phosphoric acid, and 500 parts of water, after which they are washed with water. A second and sometimes third treatment with this solution and washing with water is resorted to. In some cases, when fine-grained plates are required, a bath containing 1 part of sulphuric acid in 100 parts of water is used instead of the mixture of nitric acid, phosphoric acid, and water, as the former in no way interferes with the grain. Finally, the plates are washed with a weak solution of alum (1 part of alum to 50 parts of water), after which they are dried and are then ready for use. The plates produced by this process are absorptive and sensitive to grease, and of a similar nature to lithographic stones. Moreover, they retain their light color after being submitted to the aforesaid baths.—*E. Forrest, New Southgate, and* ***F. L. H.*** *Bucholz, London.*

The Blanco Encalada.

The Chilean government may be congratulated on their new cruiser, the Blanco Encalada, built by Messrs Armstrong, Mitchell & Co., at Elswick, and engined by Messrs. Humphrys & Tennant, which has just completed her official trials off the Tyne with the most successful results. The new vessel, which has a displacement of 4,500 tons, is built of steel and is sheathed with wood and coppered, so as to enable her to keep the sea for some time without the necessity of being docked. At her speed trials she averaged 21·75 knots with natural draught and 22·78 with forced draught, which results were considered most satisfactory; she was also found to be exceedingly handy under way. Her armament consists of two 8 inch breech-loading guns, mounted as bow and stern chasers, ten 6 inch quick-firing guns, of which four are carried in sponsons, and can fire two ahead and two astern, the remainder being carried on the broadside; she also carries a very powerful armament of smaller quick-firing guns, and is fitted with five tubes for discharging torpedoes. She has bunker accommodation for 900 tons of coal, which we may assume will enable her to steam over 8,000 knots at 10 knot speed. Her vital parts are protected by a steel turtle back running the whole length of the ship. She is fitted with two masts with military tops, has a high freeboard throughout, and altogether gives one the impression of being a handy and weatherly ship.

THE Rio Grande for more than 200 miles above El Paso, Tex., is probably the crookedest and most winding stream on the continent.

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New Mode of Sinking Foundations in Waterways.

The lighthouse board has, on its own account, been trying to ascertain the character of soil under the Diamond Shoals, which run from Cape Hatteras, N. C., ten miles out into the ocean, and upon which many vessels have been wrecked, as there is an appropriation of $500,000 available for a lighthouse.

Under the direction of the board, Julius E. Rettig, superintendent of construction, some time ago began the construction of a simple but ingenious apparatus which is described in the Baltimore *American*. It had the form of a skeleton prism, 20 feet square and 32 feet high, built up of hollow wrought iron columns, hollow wrought iron struts and tie rods, and cast iron sockets at the corners, carrying on the upper end a platform. The structure weighed about thirty-two tons, and was floated by two pontoons, each 24 by 9 by 6 feet, which were clamped to the structure so that they could be liberated as soon as the skeleton was sunk upon the shoal. Through each of the four hollow vertical columns of the structure passed a solid wrought iron pile, 6 inches in diameter and 50 feet in length, having on its lower end a cast iron disk 3 feet in diameter and on its upper end a screw thread and a cast iron flange nut. The pile was held up by a clamp neatly fitted into a recess, which was fifteen feet from the upper end. The disk at the lower end was cored in such a manner that a water current could pass through it and that the water could escape through two 1½ inch openings through the face of the lower disk. A number of wrought iron water pipes and lines of rubber hose were also put on this structure, in order to conduct water under pressure from the tugboat, which was in attendance, to the four disks.

The apparatus was erected first upon a barge and then lifted off by the large shears at Newport News and transferred to the water. When properly rigged for transportation to the site, it drew 21 feet. In this condition the apparatus was towed out to the shoal, and after waiting a day or two for favorable weather the structure was successfully sunk at a point previously marked by the United States Coast and Geodetic Survey. Within fifteen minutes afterward the pontoons were disconnected and drifted off, and when the vessel had been securely moored alongside structure, it required but three-quarters of an hour to sink the iron disks of the piles 13 feet below the bottom of the ocean. By bolting the flange nuts of the piles to the upper sockets of the structure, the apparatus was completely secured to the bottom. In order to determine the character of the soil, a pipe of two inches in diameter was sunk from the platform of the framework into the bottom of the ocean to a depth of 105 feet.

This is the first time that borings have been made by such an apparatus in such manner, and the whole work, as designated, proved a complete success in its application. The planting of the framework at the site and making the borings occupied in all only nine and one-half hours. The material brought up from the depth of 105 feet consisted of fine black alluvial sand mixed with small shells and mud—a material most unfavorable for carrying heavy loads, and easily scoured by the strong current existing on the shoals. The results thus far obtained seemed to indicate that perhaps a skeleton structure, with its lighter weight and small wind and wave resistance, will be more suitable to the conditions than a solid building, especially when it is considered that the appropriation made by Congress is far too small for the latter, even if such were feasible, but ample for a skeleton one. The cost of making this examination of the soil was but $6,000.

Another Expedition to the North Pole.

A paper was recently read before the Geographical Society, London, by Mr. F. G. Jackson on "The Jackson-Harmsworth Polar Expedition." Mr. Jackson said that he was on the eve of leading a fully-equipped expedition to the north. He had selected Franz Josef Land as the first objective of his expedition. The day of large expeditions was gone. Nansen sailed into the ice with thirteen men, and he proposed to disembark on Franz Josef with no more than eight or nine. One of the great features of their plan and the advantage of their chosen route was the almost elaborate series of depots which it was their present intention to erect. Their supplies would be moved up from the base to the first depot, and then from depot to depot until they had behind them a long array of well-stocked larders; and at the last would require only to carry with them food for a few weeks.

Mr. Alfred C. Harmsworth, a fellow of the society, was bearing the whole of the large cost of this expedition and sparing no pains to make the expedition successful. The ship in which they were to sail from the Thames in July was the Windward, the well known Peterhead whaler, built with special reference to ice navigation, and consequently of enormous strength. Of boats they had several types, foremost, of course, being the familiar whaling boat; next came a copper boat, with deep collapsible canvas gunwales, invented by the Rev. E. L. Berthon. Then there was an aluminum boat, built on the lines of the copper boat, but of course very much lighter. There were also boats of light pinewood, bolted and pinned with oak, and a birch-bark canoe. Of sledges they had seventeen, made of ash, with side rails in most cases of bamboo. The furs were, perhaps, one of the most interesting parts of the equipment. The first garb was the reindeer skin militza, a tunic made of brown reindeer hide with the fur inside, and slipped over the head. The mitts were attached to the sleeve, but there was a small slit above the wrist for thrusting the hand through when necessary. The next garment was the siluk, made on the same pattern as the militza, but of the white reindeer skin, and with the hair outside. The pimmies or long boots of the Samoyads would form their usual footwear. The traveling tents were two in number, and only about thirty pounds in weight, in spite of their double walls and ribs. They shut up much like a Chinese lantern, being crescent shaped when closed and domed when opened.

His companions would be Mr. A. Armitage, second officer in the P. and O. service and a lieutenant in the R. N. R., a skilled nautical astronomer; Mr. H. Fisher, the botanical curator to the museum, University College, Nottingham, an ardent collector of wide experience; Mr. Childs, a clever chemist and a highly skilled carpenter, engineer, and photographer; a good geologist; and a surgeon.

Queer Things in Animal Life.

The greyhound runs by sight only. This is a fact. The carrier pigeon flies his hundreds of miles homeward by eyesight, noting from point to point objects that he has marked. This is only conjecture. The dragon fly, with 12,000 lenses in his eye, darts from angle to angle with the rapidity of a flashing sword, and as rapidly darts back, not turning in the air, but with a clash reversing the action of his four wings and instantaneously calculating the distance of the objects, or he would dash himself to pieces. But in what conformation of the eye does this power consist? No one can answer.

Ten thousand mosquitoes dance up and down in the sun, with the minutest interval between them, yet no one knocks another headlong on the grass or breaks a leg or a wing, long and delicate as they are. Suddenly a peculiar, high-shouldered, vicious creature, with long and pendent nose, darts out of the rising and falling cloud, and settling on your cheek, inserts a poisonous sting. What possessed the little wretch to do this? Did he smell your blood while he was dancing? No one knows.

A carriage comes suddenly upon some geese in a narrow road and drives straight through the flock. A goose was never yet fairly run over, nor a duck. They are under the very wheels and hoofs, and yet they contrive to flap and waddle safely off. Habitually stupid, heavy, and indolent, they are, nevertheless, equal to any emergency.

Why does the lonely woodpecker, when he descends from his tree and goes to drink, stop several times on his way and listen and look around before he takes his draught? No one knows. How is it that the species of an ant which is taken in battle by other ants to be made slaves should be the black or negro ant? No one knows.

The power of judging of actual danger and the free-and-easy boldness that results from it are by no means uncommon. Many birds seem to have a correct notion of a gun's range, and are scrupulously careful to keep beyond it. The most obvious resource would be to fly right away out of sight and hearing, but this they do not choose to do.

A naturalist of Brazil gives an account of an expedition that he made to one of the islands of the Amazon to shoot spoonbills, ibises, and other magnificent birds which are abundant there. His design was completely baffled, however, by a wretched little sandpiper, which preceded him, continually uttering his tell-tale cry, which at once aroused all the birds within hearing. Throughout the day did this individual bird continue its self-imposed duty of sentinel to others, effectually preventing the approach of the hunter to the game and yet managing to keep out of the range of his gun.—*Philadelphia Times.*

The Black Death in China.

The symptoms of the disease as it appears there are fever, headache, glandular swellings in the neck, armpits, and groins, nosebleed, and hemorrhagic spots upon the skin. Death takes place in 80 to 90 per cent of the cases, and usually within forty-eight hours. This is the classical description, in fact, of *the* plague, or, as it is variously known, the black death, the great death, the Bubo plague. We commented upon its appearance in the autumn of 1892 in Turkestan, where 1,300 people died of the disease in a small town in six days. It is the most frightful of all contagious diseases, yet one with which our modern civilization is totally unfamiliar. The pathologists and bacteriologists have not studied it, because it has been apparently extinct. At least it has not made its appearance in any region where a scientific student has been enabled to study it. Consequently we know almost nothing of its cause or manner of propagation. We do know that it has paid awful visits to European countries at intervals during two thousand years. It was the plague of the time of Trajan. In the fourteenth century it ravaged the whole of Europe and Asia, so that 25,000,000 people perished on the former and 36,000,000 on the latter continent. During five months of its visitation in Naples, in 1656, 300,000 people succumbed to the malady. Those who have read "A Journal of the Plague Year," by Daniel Defoe, will remember the horrors of that London visitation in 1665 as depicted by his inimitable pen; for however much we may doubt the author's actual presence in London at the time, his striking descriptions are based on facts. Sixty-nine thousand persons were carried off by the scourge in that city within a few months. Defoe speaks thus of the symptoms of the plague:

"Some were immediately overwhelmed with it, and it came to Violent Fevers, Vomitings, unsufferable Head-achs, Pains in the Back, and so up to Ravings and Ragings with those Pains: Others with Swellings and Tumours in the Neck or Groyn, or Armpits, which, till they could be broke, put them into unsufferable Agonies and Torment."

The black death visited Toulon in 1721, destroying one-third of the population. Its last appearance in Europe was in 1840–41, in Turkey and Dalmatia. European physicians of some skill were enabled to study it in Egypt in 1833–1845, but that was before the science of bacteriology was dreamed of. Since then it has occasionally broken out in western Asia, on the Euphrates in 1867–1873, in Bagdad in 1876, on the Tigris in 1877, and in some parts of Mesopotamia in 1884. There was a mild visitation on the banks of the Volga in 1878, and several European governments sent medical commissions there to investigate it, but it had disappeared before they arrived. We have already referred to its prevalence in one or two villages in Turkestan in 1892.

Not only is the plague the most fatal of all epidemic diseases among human beings, but domestic and wild animals perish, likewise, from its attacks.

We might possibly remain tranquil during its prevalence in its favorite haunts in western Asia, which are not closely united with us by the bonds of commerce and travel, but we believe there is occasion for serious consideration of the scourge now that it has begun to ravage Asiatic ports with which we have frequent communication. A disease so awful in its character and manifestation, so terrible in its progress, and one for which we are so utterly unprepared, knowing as we do nothing of its causes or manner of infection or of the means for intercepting it, certainly merits serious consideration from our government and from our health officers, especially those stationed at ports of entry for vessels from Asiatic ports.—*N. Y. Sun.*

Piperazine as a Uric-acid Solvent.

Dr. John Gordon, physician of the Aberdeen General Dispensary, has carried out a series of experiments on the comparative solvent action of piperazine (the base itself), borax, lithium citrate, sodium carbonate, and potassium citrate on uric acid in the form of (1) calculi, (2) deposits, and (3) the artificially prepared substance. His investigations differed from those which have been previously carried out—pre-eminently by Continental physiologists—in that this indicated the solvent action of piperazine in the presence of urine instead of water. The *modus procedendi* consisted in digesting the calculi, placed in ordinary test tubes containing 10 c.c. of normal urine, and maintained by a water bath at 39° C., with 1, 2, 5, and 7·5 per cent of the solvents. Charts are given which exhibit graphically the results obtained. In the trials with a 7·5 per cent solvent it is seen that sodium carbonate had practically no effect, potassium citrate (recommended as *the* remedy *par excellence* by some authorities in the uric-acid diathesis) was a very little better, dissolving only 4 per cent of the calculus in thirty-two hours, borax and lithium citrate were close together with 9 and 10 per cent dissolved, while piperazine is a long away ahead, the total loss of the calculus in the same time (thirty-two hours) amounting to 22 per cent. Where a powdered calculus of known composition was employed a 1 per cent solvent of piperazine dissolved 96 per cent in twenty-four hours. In the earliest stages of the experiment borax was equally effective, but its action ceased after eighteen hours.

The summarized results of the work—which was carried out in the pharmacological laboratory of Professor Cash, under a grant from the Scientific Grants Committee of the British Medical Association—show that the solvent action of piperazine upon uric acid under similar circumstances was greater than that of the other substances employed, while it further had the peculiar property of rendering any undissolved residue in the case of calculi soft and pulpy. The effect was more rapid and marked as stronger solutions were used (up to 7·5 per cent), though not in direct proportion to the increase of strength. This latter fact was held to indicate that piperazine is not entirely oxidized in the body, a considerable amount being excreted unchanged—as was proved by the application of chemical tests.

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Quicksilver Mining in Tuscany.

The quicksilver mines of the district of Monte Amiata rank among the most valuable and important mineral resources of Tuscany. Monte Amiata, the Mons ad Meata of the ancients, is situated in the province of Grosseto, 36 miles from Siena.

The mines are found to the southeast of the village. It has been clearly proved that cinnibar (the ore of quicksilver) was known to the ancient Etruscans, red mercurial pigments having been used by them in decorating their vases and in such paintings as the frescoes in the rock tombs of the cities of Saturnia and Sorana. Moreover, in the mine of the Siele, stone implements have been found which are held to afford proof that the cinnibar ore there was worked in the flint age. In 1878, when a French company were carrying on prospecting operations in the vicinity of Castell' Azzara, some human skeletons were found in the course of driving an adit, and close by them a gold coin bearing the inscription of Philip of Macedon. These facts would point to the conclusion that the cinnibar deposits of the Monte Amiata were known and to some extent worked at a period of extreme antiquity.

The revival of mining operations in this district dates from the year 1846, when the accidental discovery of some pieces of rich cinnibar in the bed of a torrent induced a speculator to acquire the mining rights over the surrounding lands, and subsequently to form a small company for the purpose of searching for quicksilver. No satisfactory results were obtained, and with the exhaustion of the small capital of about 1,200*l.*, operations ceased. After various vicissitudes the property was bought at auction, in the year 1865, by a Jewish merchant of Leghorn, Signor Rosselli (whose family hold it to the present day), for about 3,000*l.*; but no one then could have foreseen the brilliant future in store for the mine.

In fact, in the year 1866 it produced only 58 hundredweight of quicksilver, of the value of about 600*l.* But gradually the yield increased until, in 1876, the production reached 1,908 hundredweight, while in 1890 the Monte Amiata district produced 8,837 hundredweight, of which quantity about 85 per cent came from the Siele mine, the balance being the production of some mines of secondary importance in the same district which were discovered more recently. The total production of the quicksilver of Monte Amiata during the years 1866–93 is put at 86,507 hundredweight, of the approximate value of 800,000*l.*, the great bulk of which has come from the Siele mine, which remains to the present day as productive as ever.

The splendid success of this mine, while it stimulated research for the same mineral in the surrounding territory, which in some cases has met with favorable results, was also the cause of a plentiful crop of lawsuits before the Italian courts, involving disputes as to the rights of property in the mine; but prolonged litigation proved that the title of its present proprietors could not be successfully called in question.

In connection with quicksilver mining it may be mentioned that some fifty years ago quicksilver was discovered at a place called Capita, about twelve miles from the town of Orbetello, on the southwestern boundary of the province of Grosseto. A mine was opened up under the management of a Cornish mining "captain" named Davy, and for account of an Englishman. Some quicksilver was produced, but for some reason or other the work was abandoned in 1867, and continued so until 1893, when the mining rights were acquired by Messrs. Rae Brothers, of Leghorn, and operations of a prospecting character were commenced. The geological formation is the same as that of the mines of Monte Amiata, and the abundant indications of cinnibar met with so far encourage the expectation that the mineral in paying quantity will be found as the workings advance.

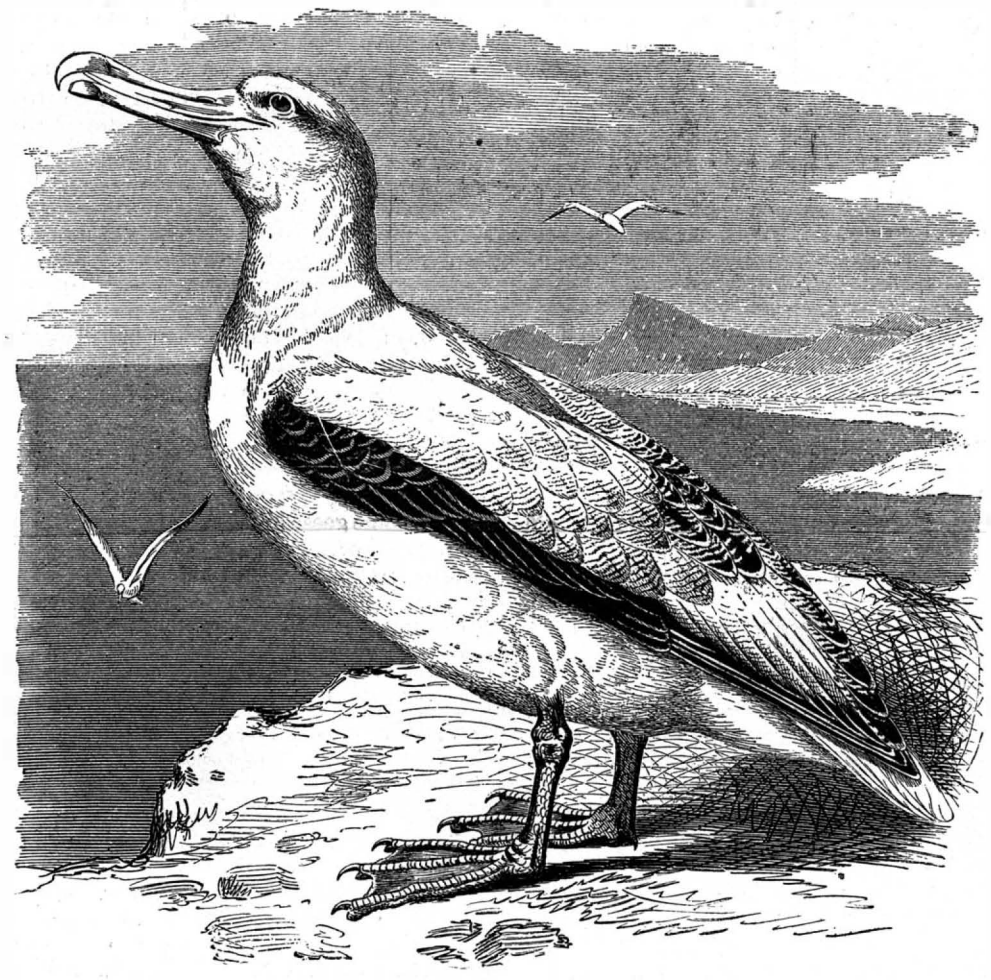
Brick Pavements.

The Director of Public Works of Philadelphia, Mr. James H. Windrim, states in his annual report for 1893: "The streets repaved with vitrified bricks, which have been subjected to the wear of ordinary business travel, have not lasted five years; there are bricks in these streets disintegrated and gone, while others are in a fair condition to withstand longer wear. If all had shown the same endurance, bricks as a material for street paving would be in greater favor. The maker knows the quality of his bricks. Those from the portion of the kiln that are 'firsts' should be sold as such, after selection by the maker. The buyer or inspector cannot always know the grade of bricks by their looks, and as long as bricks are put on the market without selection to guarantee uniformity in their quality there will be distrust and their general use for street paving will be delayed."

THE ALBATROSS.

The albatross, a bird of the genus *Diomedinæ*, and of which there are several known species, is characterized by its great size, its powerfully built body, short, thick neck, and long and powerful beak, which is compressed at the sides and curves suddenly downward with a sharp hook at the point. The feet are short, the three toes long and completely webbed; the wings are long and narrow. The abundant plumage is of a grave color, which varies somewhat, according to sex and age, and also, perhaps, according to the season of the year.

The common albatross (*Diomedea exulans*), of which we publish an engraving—for which we are indebted to Brehm's "Thierleben"—is pure white, except for the black of the wings and a sprinkling of more or less brown over the white ground when it reaches a certain age. The eye is dark brown, the bare eyelid pale green, the beak pinkish white, shading to yellow toward the point; the feet are tinged with red. The common albatross is the largest sea bird known, weighing from 12 to 28 lb. The usual extent of its wings is about 11 ft., but one was shot off the Cape of Good Hope that measured 17½ ft. Its powers of flight are extraordinary, as might be presupposed from the extreme lightness of its hollow wing bones, which are said to be as long as the whole body. Sailors have many stange notions about it, one of which is that it sleeps on the wing.



THE ALBATROSS.

Damages for Electrical Shock.

In March last, while two men were taking a constitutional in Innsbruck, they discovered a telephone wire hanging down to the ground, when one of them picked it up and promptly yelled for assistance. His friend came to the rescue, knocked the wire out of his hand with a stick, and received a shock which rendered him unconscious. On recovering, he found that the picker up of unconsidered trifles was dead. A court of inquiry has now been held, at which three of the officials of the local electric lighting company were charged with culpable negligence. It appears that they had been warned several times that telephone wires above their conductors were broken, but no attention had been paid to the matter. The telephone wire in question had fallen across the conductor, resulting in the accident. One of the officials has been sentenced to one month's imprisonment, the second to four months' imprisonment, and the third has been discharged. In addition, an indemnity of 100 florins has to be paid to the injured man. Nothing has been awarded to the relatives of the dead man. It therefore appears that in Innsbruck it is less expensive to kill a man than simply to knock him down.

The English Language in the United States.

There has been, from time to time, serious talk in England of the reform of English orthography. The word is a misnomer in relation to the English language, for there is nothing orthographic in it. No language, except perhaps the Etruscan, was ever reduced to such phonetic decay. The simplest and most easily acquired, as a spoken language, of all European tongues, its spelling brings the foreigner to despair. It is impossible for any man who has learned the sounds given to the letters, and acquired them in the highest possible exactness as elements, to go on from that and learn to talk the language so as to be generally understood. This is a disgraceful fact, explain it how we may. To say that our language is the simplest of the European tongues in its grammar, in its construction of phrases, and especially in its inflections, is to claim what no one contests; and that it is the easiest to learn is a common remark by those who have studied it; but coupled always with the qualifying criticism that the written word gives but a poor indication of the pronunciation. Make it phonetically correct, and it becomes the easiest language to acquire in the world. This is for the foreigner. For ourselves, however, there is a kindlier service in the elementary education of our children. As this is now carried on, it requires in many cases two or three years for a child to learn to read, and, in not a few, many years to master the spelling of the language. By a phonetic system this time is reduced, for any language, to six weeks on an average. The suggestion of the Americanization of the English language carries with it, as the logical consequence, a radical reform, which the insular mind is too conservative to accept, but which will, when accepted by the expanding branch of the race, so facilitate the acquisition of the language that no excuse will remain for the construction of a new universal speech; and it will at once establish the position of our tongue as not only the simplest in construction and the widest in extent, and, therefore, the most useful, but as the most easily acquired of all human languages. To this end, however, the reform must be radical. It is trifling with the subject to throw out a useless *gh* here and a superfluous *m* or *l* there; not only must the useless be eliminated, but the incorrect and inexact must be made correct and exact; there must be no two characters for the same sound, or two sounds for the same character. The change must, therefore, be radical in character, but conservative in form. The means of combining these conditions is furnished by the Merington alphabet. For the silent letters it employs italics; for the sounded vowels, accents; and for sounded consonants, modifications of the form so slight as not to offend the accustomed sense, while they convey to the beginner all that is requisite in the indication of modification of sound. The printed page, therefore, corresponds so nearly to the present form that the eye is not offended, the history of the language is kept intact, and the books already printed will have only a slightly archaic character to those who follow us, while the words once learned in the new character will be perfectly well known in the old. That afterward the progressive reform shall proceed little by little to throw out the useless letters, and insist more forcibly on the differentiation of the modified, we cannot foresee or provide for or against. What is certain is that a reform will come when the desire for it has reached the requisite strength; and the longer that reform is delayed the more reckless of conservative conditions it will be, and the more our immediate successors will have lost. And, after all, the changes will be only the putting of what we now get in our dictionaries into our text books. With this change, however, an intelligent foreigner can learn English in six months, not only, as now, to read it, but to be able to speak it intelligently and correctly—an accomplishment which is usually the result of years of study.—*Century.*

Wonderful Speed of Atlantic Liners.

The highest recorded speed on the Atlantic as an average for the whole passage is 21·9 knots per hour, performed by the Cunard line steamer Lucania. This has now been nearly equaled by her sister ship, the Campania, which has just made the passage from New York to Queenstown in 5 days, 13 hours, 8 minutes over a total distance of 2,905 knots, her average speed having been 21·82 knots per hour.

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Wonderful Speed of a New Torpedo Boat.

The Havock and the Hornet proved themselves able to do—one a little over 27 knots, the other a little over 28; but the Daring, built by Messrs. Thornycroft, of Chiswick, beat all records at her trial on the Maplin Sands measured mile, June 23, and attained the unexampled speed of more than 29¼ knots. The run was made against the tide, moreover, and the Daring all the time was blowing off steam hard, as though she might, if it had been thought necessary to press her powers to the uttermost, have put on certainly another half knot to her top speed. Having, however, as it was, beaten all records so triumphantly, Mr. Thornycroft preferred for the occasion to let well alone and rest on his laurels. There was no possible doubt about the performance, for it was independently checked point by point by the Admiralty inspectors sent out in the Daring to report officially on the run, as well as by the special recording instruments set up on board, and by a number of experts, including Sir Frederick Bramwell, who watched the behavior of the Daring, chronograph in hand, with the closest interest. The exact figures for the record-breaking run were—from sea mark to sea mark, constituting the Admiralty measured mile—time, 2·3 minutes; speed, 29·268 knots; revolutions of propellers, 395.

There were three high speed trial runs on the measured mile in all, after a series of progressive trials to time the mile at various revolutions of the propellers. The Daring, by the way, is a twin screw vessel. The records of the first two high speed trial runs were: No. 1. Against the tide—time, 2·76 minutes; speed, 28·214 knots; revolutions, 383. No. 2. With the tide—time, 2·6 minutes; speed, 28·571 knots; revolutions, 385. The final and record-breaking run of 29¼ knots, or 33½ miles per hour, was made against the tide, with a slight sea, and against a strong breeze. In spite of the tremendous pace, the vibration of the little vessel, as she literally tore ahead through the water, was practically insignificant, and the Daring could have fought her guns throughout without inconvenience to steadiness and accuracy of aim.

The Daring's trial trips were carried out under the personal supervision of Mr. John Thornycroft, Jr., and Mr. S. Barnaby, and among those present on board to witness the day's work were Sir Frederick Bramwell, Mr. H. O. Arnold-Forster, M.P., Professor Crookes, F.R.S., Professor Vernon Boys, Mr. J .T. Thornycroft, Sr., who himself designed the Daring, and Mr. John Donaldson. The brilliant result of the day's performances proved, it was announced, more successful than even the builders of the ship had quite expected, and surprised them not much less than it astonished every one else who had the good fortune to be on board the Daring.

Photography Without a Camera.

There are many who would "take pictures" were it not for handling of chemicals and possible staining of fingers which the development of the image on the plate involves, and the labor of carrying a camera and the necessary "traps." But photography offers a wide field for recreation and is gracious to the humblest of its votaries, as well as to those whose dainty fingers may not be soiled by contact with pyro and other dark-room "messes." It is not necessary to have a costly "box," or an expensive astigmatic, double back-action telephotoscopic objective to get lots of pleasure out of one of the many stages of photographic work. With an ordinary 50 cent printing frame, a sheet of clear glass to fit it, a bottle of prepared toning solution, a package of printing-out paper and a pin, it is easy to make a fine collection of pictures. Fabrics, laces, leaves of trees, certain flowers and other things can be reproduced, and a little artistic handling will accomplish surprising results.

All such reproductions will give a white picture on a black ground. For laces, except of the thinnest, most cobwebby sort, it is necessary to exercise some care in handling. Lay the frame face down, with the back out. Put in the glass, and then lay the lace you wish a picture of on the glass, being careful to see that it is smooth. Then put in the paper, film side to the lace, and then the back goes in place, and is fastened by its springs. The pin is to be stuck in a corner on the face of the frame, standing straight up, and when the frame is held so that the pin casts no shadow, the sunlight is falling squarely on the lace and the paper. When the paper not covered by the lace is black, take out the sheets and follow the directions on the bottle of toning solution.

In reproducing leaves it is well to expose them to direct sunlight for some time before placing them in contact with the sensitized paper, in order to be sure there is no moisture on them, dampness having a bad effect on the paper. For greater convenience the leaves are sometimes fastened to the glass in the frame. Skeleton leaves, which are often found in the woods and are caused by the slow decomposition of the epidermis, give a beautifully delicate lace-like picture by this process. These skeleton leaves can be prepared by spreading the perfect leaf over some smooth, soft surface, and gently striking it with a soft brush. The framework of the leaf will soon be left clean and entire.

One of the beauties of this method of making pictures is the wide scope given to taste and skill in the matter of selection. The numerous contact and printing-out papers, the carbon, bromide and platinotype processes, are all available, and each in turn is susceptible of variation and change until a bewildering variety of prints in different colors and styles can be produced. The simplest of all, however, is the ferro-prussiate, or common blue-print. While this does not always give such exceeding sharpness of line as some picture makers seem to think indispensable, the fact that all the treatment necessary is a thorough washing in clean water, letting the print, after being pressed between blotters, dry in the sunlight, is a strong argument in its favor.

The question of expense need hardly be considered. The first outlay for a 4×5 inch picture would be less than $1.25, and that would supply material enough for twenty-four blue-prints, after which the running expense of the plant would be almost nothing.—*N. Y. Tribune.*

Sir Henry Layard.

The Right Honorable Sir Austen Henry Layard, explorer, archæologist, diplomat, and art critic, died at his London residence on the 5th of July, after an illness of several weeks. He was born in Paris in 1817. After studying law he started on an exploring tour in 1839. The British Museum owes some of its chief treasures to this tireless explorer. His works on Nineveh gave him an enviable reputation, and as they were charmingly written, were extensively read both in Europe and the United States. Sir Henry's edition of Kugler's "Italian Painting" is a very authoritative work. He was connected with the British embassy in Constantinople from 1849 to 1852, and was Under Secretary for Foreign Affairs in 1852 and from 1861 to 1866. In 1869 he was appointed minister to Spain. He was ambassador to Turkey from 1877 to 1880. He was Lord Rector of Aberdeen University in 1855-56. During the latter part of his life Sir Henry lived much of his time in Venice.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR FENDER.—William V. Cleary, New York City. This fender is normally held a little distance above the track, but may be instantly released from the platform, when it springs downward into close contact with the track, so that nothing can pass beneath it. It has an inclined front end, is made of a light framework covered with netting, and held to slide vertically on parallel shafts supported beneath the car, arms connecting the shafts with the fender, while there is a spring for depressing the arms, and a catch rod connected with one of the arms extending up through the car floor.

PILOT BAR LIFTER.—Peter G. Cotter, Yuma, Leonidas Holladay, Pima, and Ransom J. Duncan, Yuma, Arizona Ter. A cylinder connected with the steam or air supply is mounted at the front of the locomotive, in such way that its piston may either directly or through a cam be made to lift the pilot bar, the cylinder being capable of an oscillating or swinging motion to accommodate the movement of the pilot bar to either side, and the mechanism being under the control of the engineer in the cab. The improvement renders its unnecessary for the brakeman to mount the cowcatcher to make a coupling with the pilot bar.

CONDUIT ELECTRIC RAILWAY.—John H. Tyrrell, New York City. According to this improvement the slotted conduit has a metallic supporting tube with diverging flanges at its lower side, there being an open bottomed clamp embedded in insulating material within tube, the line wire being held by the clamp and projecting from the insulating material in such manner that easy contact may be made with the line wire, which is perfectly protected and insulated. Means are also provided for easily shifting the trolley from side to side, and the construction is such that the trolley may be easily disconnected and the brakes applied.

REFRIGERATOR CAR.—Ferdinand E. Canda, New York City. In this car a hatch is arranged in the roof above the ice crate, there being superposed air tight doors for closing the hatch and a recess frame rigidly secured to the top of the car over the hatch, while a lid made in two sections is hinged to the screen frame at the center. The arrangement is such that a low or high temperature is secured by means of a constant and natural circulation of dry air, the temperature being maintained with great economy.

Electrical.

TELEGRAPH REPEATER.—Alfred D. P. Weaver, Jackson, Miss. This invention relates to instruments to cause a message coming over one line to be repeated over another line without the aid of an intermediate operator. The improvement consists in the peculiar construction and arrangement of parts and of the circuits and their connections, the object being to cheapen and simplify the instrument, reduce the number of connections, economize the local batteries, reduce the liability of failure, avoid mutilation of signals, and enable it to be more easily understood by inexperienced operators.

MACHINE FOR TEACHING TELEGRAPHY.—Thomas M. Crepar, Clare, Mich. Upon a case having a slot in its upper side is a receiving instrument, there being also on the case a circuit breaker having an arm projecting through the slot, the arm being engaged by projections on a traveling belt, one end of which is supported in the case and the other end on adjustable pulleys outside of the case, the belt being driven by a clock mechanism. By this means telegraphy may be rapidly, accurately, and mechanically taught, the machine being adjustable for a greater or less capacity of words or characters, and for the desired speed.

Mechanical.

STOP MOTION FOR DOUBLING FRAMES.—Elias Richards and Robert Lucas, New Orleans, La. This invention relates to spinning machinery, and comprises two rollers between which pass strands, slivers, or sheets, and locking devices with movable and stationary portions for holding the rollers, the movable portions normally locking with the fixed portions, and being held in disconnected position by the strands, slivers, or sheets, in such a manner that, on the breaking of one of the strands, slivers, or sheets, the rollers will be held immovable. This stop motion is automatic, and prevents single strands from passing through the drawing rollers in case one of the strands breaks.

Agricultural.

PULVERIZER AND HARROW.—Albert D. Powers, Owensborough, Ky. In this machine rows of teeth are located at the front and rear of a wheel-supported frame, the teeth being actuated from the same driving mechanism and alternately operated, being raised by the driving mechanism and dropped by gravity. The teeth are so shaped that the front ones act as a series of hoes and the rear teeth act in the capacity of a rake. All of the teeth may be readily raised from the ground when the machine is to be moved from one field to another. A construction is also provided for which will enable the machine to pass over young plants and cultivate the ground at each side of the plants.

Miscellaneous.

PNEUMATIC GRAIN CONVEYER.—Frederic E. Duckham, Millwall Docks, London, England. This is an improvement on a former patented invention of the same inventor, of an apparatus for loading and unloading ships' cargoes, and consists in the combination with oscillating two-chambered air lock delivery boxes of pneumatic apparatus working by exhaustion, with means whereby the conveyance of grain is effected by a current of air under pressure, the means comprising a closed chamber into which the air lock delivery box discharges, supplied with air under pressure and containing a nozzle with air supply sleeve immersed in the grain and connected to a conveying pipe leading to the place of delivery.

PNEUMATIC GRAIN CONVEYER DELIVERY APPARATUS.—This is a further patent of the same inventor for an improvement to cause equilibrium of air pressure to be automatically established between the exhausted hopper and the chamber of the air lock delivery box about to be filled therefrom before the chamber arrives at the filling position. This invention is also an improvement on a former patented invention of the same inventor

SHOE FASTENING.—Thomas U. Walter, Huntington, West Virginia. The shoe body, according to this improvement, has an upper flap with button holes, each having a downwardly and outwardly projecting keeper portion, while an elastic member so connects a button-holding flap with the shoe body that when this flap is pulled on it moves diagonally outward and upward. The heads of the buttons on the button flap are adapted to register with the inlet portions of the button holes in the upper flap when the lower flap is pulled upward. The fasteners are all engaged or disengaged by a single movement of the fastener holding flap portion of the shoe.

HEATER.—Harriet C. Cowdrey, New York City. This is a simple device in which a lamp is employed to heat a hall or other apartment, without vitiating the air. A shell having a series of openings is provided with a shield fitting tightly around the lamp, the shell having near its lower end a row of openings for the admission of air, while openings near its upper end permit the egress of the heated air. A pipe from near the upper end of the shell leads either to the chimney or out of a window.

ICE CUTTER.—John G. P. Putnam, Claremont, N. H. In a main frame is journaled a driving shaft, with which is geared a propelling shaft carrying propelling wheels and a shaft carrying a circular saw, there being hinged runners for raising and lowering the main frame. As the operators turn the main driving shaft a simultaneous forward movement is given to the frame and a rotary motion to the saw, to cause the latter to cut the ice as the machine moves forward.

BUCKSAW FRAME.—Thomas C. Knowles and William J. Adams, Newton, Mass. The frame proper, according to this improvement, is made of a single flat piece of steel, bent in proper shape to form a handle bar, middle portion, and end bar. On the upper portion of the handle end a second handle is adjustably held by a set screw, a suitable handhold being also secured on its lower end. A light and comparatively strong saw frame is thus afforded, which may be made to serve in cutting logs of considerable thickness.

PIPE HOLDER.—John B. Davis, Moline, Ill. This is a device for holding a stove or furnace pipe securely in the chimney, and also to fasten the sections of the pipe in position to form a gas and dust tight joint. A bar secured to the pipe projects between the pipe and a thimble, the bar having an inwardly extending hook receiving the pipe and an outwardly projecting lug extending through the thimble.

RUBBER HAND STAMP.—Robert S. Hall, New York City. This stamp has a flexible rubber backing of cellular structure, its walls connected at all points of intersection and juncture with the outer margin, while the walls and the outer margin have transverse perforations, whereby a lighter and more elastic backing is afforded, giving the necessary resiliency and lessening the cost.

MARKING TOOL.—Louise Schaefer, Oneida, N. Y. This is an inexpensive and simple tool having a spur wheel adapted to penetrate the fabric to be marked and pick up pigment from a marking board on the under side of the fabric, and having also a chalk holder in which chalk is held adjustably to mark the upper side of the fabric over which the tool is run. The spur wheel may be placed in advance of or behind the chalk holder, or the wheel may be dispensed with and the chalk holder alone used.

REGISTER FOR BASKETS, ETC.—Austin B. Culver, Westfield, N. Y. This improvement is more especially designed for registering the count of baskets of grapes as they are passed into the cars, lessening the labor and saving the time of the operator, while insuring the keeping of a proper tally. Combined with a sliding and spring-supported table is a dial carrying a ratchet wheel, a lever loosely pivoted and having a pallet head engaging the ratchet wheel, and a spring-pressed pitman connecting the lever with the table.

WATER CLOSET SEAT.—Patrick J. Cahill, Utica, N. Y. This is a seat which may be quickly and conveniently fitted upon the bowl, the spud of the bowl and the spud coupling being utilized as fastening devices, or an equivalent of the spud, and the seat being so connected with the bowl that it is adjustable to any size bowl. The construction is such that when either the seat or its cover is opened, partially or entirely, the hinges will not be placed under undue tension.

SASH WEIGHT.—George S. Sergeant, Greensborough, N. C. This invention provides a method of connecting and interlocking two or more short or light weights to form a heavier weight, no bolts, rivets or knotted cords being employed for connecting the weights, and the sectional weights being as cheap as the old style single weights. All of the weights, in each of several forms, may be used as taken from the mould, and a sectional weight of given diameter weighs almost the same as a solid non-sectional weight of the same length.

PENHOLDER.—Edwin P. McCollom, David City, Neb. The holder proper, according to this improvement, is formed of a rod having a head with intermediate and return wings with a pen seat between them, while a sleeve sliding on the head incases and compresses it to clamp the pen. The pen may at any time be conveniently discharged from the holder without soiling the hands or it may be incased and put in the pocket when not in use.

TENT AND SUPPORT.—Patrick F. Noonan, Fort Stanton, New Mexico. This tent has a central tubular support capable of use as a stove pipe, dispensing with the ordinary pole and tripod. The cap is so arranged as to obviate the necessity of its removal, and to prevent leakage in wet weather, the improvement providing for a stove in the center of the tent and the utilization of the greatest possible portion of the space.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

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NEW BOOKS AND PUBLICATIONS.

CLINICAL MANUAL FOR THE STUDY OF DISEASES OF THE THROAT. By James Walker Downie, M.B. New York: Macmillan & Co. 1894. Pp. xvi, 268. Price $2.50.

This work is a clinical manual which, from the standpoint of the physician, seems to be very attractively presented. Of late years the throat has been much more an object of interest than in older days, and the bearing of throat diseases on the entire nervous system, and even on the intellect itself, are fully recognized. It is not too much to assume that this work, in view of the general interest now taken in the throat, will find a place in many libraries other than those of the physician or specialist.

HEADWATERS OF THE MISSISSIPPI. By Captain Willard Glazier. Chicago and New York: Rand, McNally & Co. 1893. Pp. 527. Price $2.50. No index.

A much vexed subject, the source of the great American river, is here treated from the historical point of view as well as from the geographical one. The book is enlivened by very numerous illustrations, graphically showing the scenery and the adventures of the exploring parties in the wilderness, and the grounds for believing that Lake Itasca is not the ultimate source of the Mississippi are given in detail.

CELESTIAL OBJECTS FOR COMMON TELESCOPES. By the Rev. T. W. Webb. Revised and greatly enlarged by Rev. T. E. Espin. In two volumes. Vol. I. London and New York: Longmans, Green & Co. 1893. Pp. xvii, 233. Price $1.75. No index.

The Rev. Mr. Webb's work has now reached the fifth edition. A very short biographical note of the author, now deceased, with his portrait, is a feature to be noted. By common telescopes achromatics with apertures of 3 to 5 inches are meant. The book treats of the instrument and mode of observation, and then goes on with the treatment of special objects of view in the planetary worlds as well as comets and meteors.

SCIENTIFIC AMERICAN

BUILDING EDITION.

JULY, 1894.—(No. 105.)

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1. An elegant plate in colors showing a half stone and half frame summer cottage erected at a cost of $4,500. Perspective views and floor plans. Mr. H. Howard, architect, New York City. An attractive design.
2. Plate in colors showing a Queen Anne dwelling at Melrose, Pa., recently erected for W. H. Miller, Esq. Perspective elevation and floor plans. Cost $8,500. Mr. A. M. Walkup, architect, Philadelphia, Pa.
3. Full page engraving of Nonsuch Palace.
4. A half-timbered house at Rosemont, Pa., recently erected for John H. Converse, Esq., at a cost of $11,000. Perspective elevation and floor plans. Mr. T. P. Chandler, Jr., architect, Philadelphia, Pa. A handsome design.
5. Engravings and floor plans of a cottage at Jamaica, L. I., recently completed for B. S. Waters, Esq. A popular design of American style. Cost $5,800 complete. Messrs. Davis & Oborne, architects, Brooklyn, N. Y.
6. Residence at Yonkers, N. Y., recently erected for Cheever N. Ely, Esq. Perspective elevations and floor plans. Mr. Augustus Howe, architect, New York. A pleasing design.
7. A dwelling at Hackensack, N. J., recently erected for Mrs. Maria Bogart. Perspective elevations and floor plans. Mr. W. L. Stoddard, architect, Tenafly, N. J. A model design.
8. A colonial cottage at Hartford, Conn., erected for W. F. Goody, Esq. An attractive design. Floor plans and perspective elevations. Cost $4,750 complete. Mr. Henry D. Hooker, architect, New York City.
9. A residence at Edgewater, Ill., recently erected for G. F. Lange, Esq. Perspective elevations and floor plans. A pleasing design.
10. A residence at Bryn Mawr, Pa., recently erected for Prof. Herbert W. Smyth. Three perspective elevations and floor plans. Cost complete, $6,500. Mr. J. C. Worthington, architect, Philadelphia, Pa.
11. A picturesque country cottage at Greenwich, Conn. Perspective elevations and floor plans. Messrs. A. H. Throp & W. S. Knowles, architects, New York City. An attractive design.
12. Design for a stairway.
13. Miscellaneous Contents: The passing of the carpet, illustrated.—Why not remodel the old home? illustrated.—Mott's "Sunray" steam boiler, illustrated.—Modern brick machinery.—The "Ideal" sash pulley, illustrated.—Improved wood working machinery, illustrated.—Elevators for the New Commercial building, Philadelphia. — Architectural wood turning, illustrated.—The Beveridge cooker, illustrated.—The Variety wood worker, illustrated.—The "Monarch" fireproof partition, illustrated.—View of the Hotel Phœnix, Winston, N. C.

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References to former articles or answers should give date of paper and page or number of question.
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Minerals sent for examination should be distinctly marked or labeled.

(6153) A. H. M. asks: 1. How can shellac be thinned after it has become thick? A. Add alcohol. 2. Suppose a bullet be fired perpendicular to the surface of a flat rock. Will it rebound with as much force as it went, and what per cent? (Provided the stone fired at were considerably harder than the bullet.) A. No. The lead will flatten or go to pieces and develop heat. 3. How can iron and brass be soldered together, using common solder? I have tried the usual way, but can't make it work. A. If the iron is wrought iron, use soldering acid. If cast, you cannot make a good job of it. 4. Is it true that putting oil on the strings of a tennis racket improves the racket? A. This is considered good practice, as tending to preserve the strings. 5. I connected several small motors with the terminals of an incandescent lamp (run by an alternating current) in place of the lamp. The motors merely buzzed. I tried several methods of connection and finally hit upon the shunt method. The motors all started up violently. Why was it that the alternating current would not make them go when the shunt would? A. The relative lag of the parallel coils and cores is the cause of the working. 6. Is there such a thing as a pea sheller? A. Such have been invented. 7. What is the lifting power of the average man of 21? A. Perhaps 250 pounds. It depends on the conditions of the lift.

(6154) F. L. B. writes: I wish to pump a quantity of water into a tank abont 20 feet high, using a small gasoline engine for the motive power. Please inform me which will require the more power, to have the pump on the ground and use it as a force pump or have it at the top of the tank and draw the water up by suction, the water being pumped from a pond near by. A. There will be no difference in the actual power required in either position of the pump. The convenience of always having the suction pipe fully charged, or if not charged, of easy charging by the pump alone, is always a recommendation to set the pump as near the water level as possible or convenient.

(6155) F. W. writes: On June 28, in my capacity as display man for the weather bureau, I hoisted two marine signal lights, one white and one red. In the morning on taking the lights down I noticed that the white light had attracted thousands of small insects, the lower part of the lantern being covered, while the red light which hung only two feet below had attracted none. When the red light hangs alone it is usually covered with insects in the morning, as the white light was on the above occasion. A. It has been noticed that insects that are attracted by bright lights in the open air circulate around and above the light before coming in contact with it or its lantern. The glare of the white light would partially blind them as to the presence of the red light above, and the insects would lodge against it in their erratic flight above the white light.

(6156) V. G. A. asks why it is that copper runs free from blow holes from the smelting furnace into the ingot, and then when you remelt and cast it, it is full of blow holes. A. Copper vaporizes or boils at temperatures above its high melting heat. In casting ingots a lower temperature is used, on account of the easy flow of the copper into the open ingot mould. The open top and iron body of the mould allows the copper to solidify from the bottom and the vapors to readily free themselves at the liquid surface, which is the last to solidify. On the contrary, when casting copper in sand or other close moulds, the whole surface of the casting commences to solidify at the instant of contact with the surface of the mould, and thus imprisons the vapors or gases within the body of the metal. Two to three per cent of tin added to the copper just as the metal begins to melt makes the copper more fluid and reduces the melting temperature. This allows the metal to flow more freely into the sharp parts of the mould and gives better vent to its contained gases. Such castings have the value and properties of pure copper for most purposes, with the additional quality of solidity.

(6157) F. O. W. says: Would you kindly tell how to remove freckles from one's face and hands? A. The following is quoted by *New Remedies* from a German medical journal: Sulphocarbolate of zinc, 2 parts; glycerine, 25 parts; rose water, 25 parts; spirits, 5 parts. Dissolve and mix. The freckled skin is to be anointed with this twice daily, the ointment being allowed to stay on from one-half to one hour, and then washed off with cold water. Anæmic persons should also take a mild ferruginous tonic. In the sunlight a dark veil should be worn.

(6158) A. H. L. asks: 1. What horse power are the motors on the trolley cars usually? A. They vary. Two 25 horse power motors are often used. 2. How many amperes current would they require to operate them on a ten mile road, the road being wired in the most economical manner possible without losing energy, with either the three voltages, 500, 1,000 and 1,500? A. Your conditions are incompatible. If there were as you stipulate no loss of power, the amperage asked for would for 50 horse power be respectively $a\ \frac{50\times746}{500}$ $b\ \frac{50\times746}{1000}$ and $c\ \frac{50\times746}{1500}$. But the cars are really run at such high power and there is always a loss on the line. 3. What size wire, and also what would be the most economical manner of wiring 10 miles of road (taking into consideration the cost of wire, and the amount of power lost through resistance) at the three voltages 500, 1,000, and 1,500? A. It depends on the number of cars to be run. The wires must be made larger, as more cars are used for the same loss of energy.

(6159) D. writes: It is reported in the technical papers that about 160,000 cubic feet of gas is converted from one ton of average coal, but we find that only 7,000 to 10,000 cubic feet of illuminating gas is made available in gas works for commercial supply. Will you please inform me if these figures are correct and what becomes of this large difference of gas product? A. The large yield quoted refers to producer gas. This is made by blowing a mixture of air and steam through coal, which is thereby kept incandescent and burns. The products of combustion include hydrogen, carbon monoxide and some carbonic acid gas and all the nitrogen of the air used. Such gas is of very low quality and only available in metallurgical and similar processes.

(6160) E. F. C. asks: How many amperes pass on a 500 volt lamp circuit with nine 54 volt lamps in the series? A. It depends on the size of the lamps. Assuming them to be 450 watt lamps, then a current of 8⅓ amperes is required.

(6161) W. E. C. asks: Will steam heat at 100 pounds pressure draw the temper from steel or brass springs, supposing that the springs are working in the steam? What is the temperature of steam at 100 pounds pressure? A. Yes. Steel springs, if made somewhat harder than the usual spring temper, will last a year or two, depending upon their work. With considerable movement they soon lose their tension, and after a few times setting up, lose their strength. Brass springs are of little value at the temperature of steam heat. Steam at 100 pounds pressure has a temperature of 338° Fah.

(6162) C. E. P. says: Kindly inform me how to make an amalgam for the rubbers for an electrical (frictional) machine. A. The rubbers of glass electric machines are coated with amalgam, consisting of equal weights of tin and zinc melted together, with twice their joint weight of mercury added during fusion.—*Kienmayer*. Another amalgam is tin 1, zinc 2, mercury 4. For ebonite disks the amalgam should be softer than for glass. Grease is mixed with the powdered amalgam to give it softness and make it stick. In France bisulphide of tin is used.

(6163) A. N. M. asks: If wood weighing 395 pounds per cubic feet is under water a great length of time, how much will its buoyancy be decreased, caused by water soaking? Is there any way to prevent this absorption, as by treating with pitch, creosote, etc.? What timber would be the best for use for buoyancy on floating pipes in a river, considering cost, weight, durability, etc.? How would you construct the piston and packing of a hydrostatic machine (mercury being the fluid), so as to prevent any leakage of mercury with a pressure on piston of 40 pounds per square inch? A. The time for becoming non-buoyant varies very greatly with different woods, depending somewhat upon their porosity and resinous nature. The commonly called hard woods may lose their buoyancy in from one to five years, according to their porosity. The flotation can only be maintained by thoroughly pitching the dry wood, thereby closing the air cells from the entrance of water. The best wood for flotation is yellow and white pine, cedar and hemlock, dry and thoroughly coated with hot pitch. Cupped packing rings of rawhide kept moist with glycerine are suitable for a mercurial pressure pump.

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July 10, 1894,

AND EACH BEARING THAT DATE.

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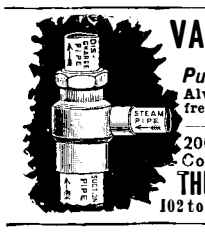
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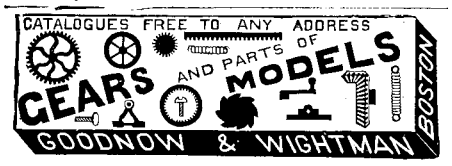
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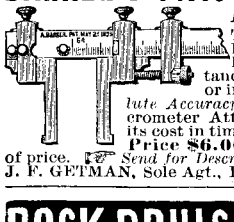
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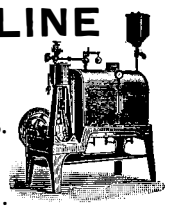


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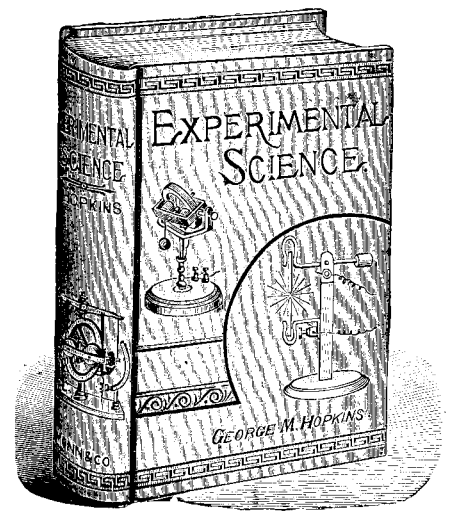


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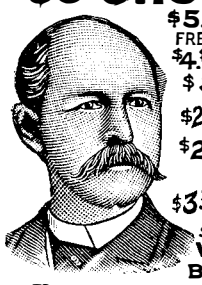
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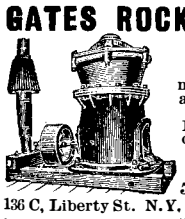


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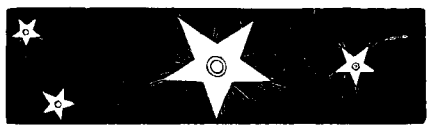
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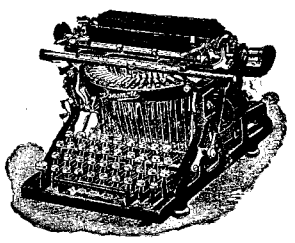
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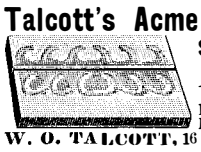
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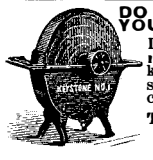
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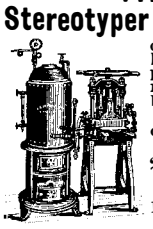
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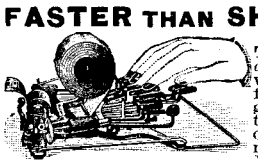
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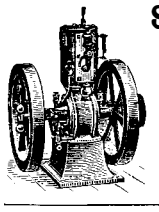
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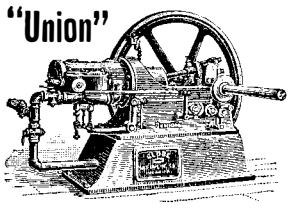
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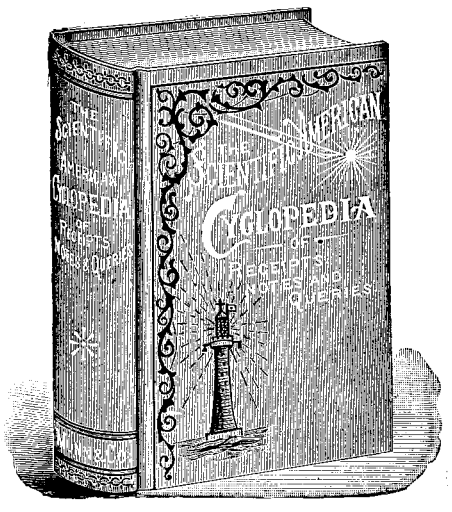
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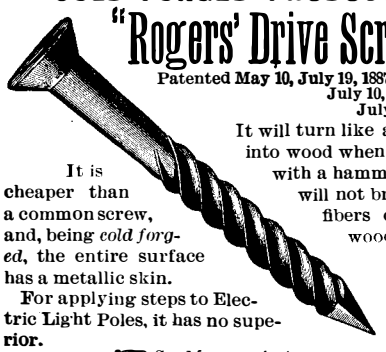
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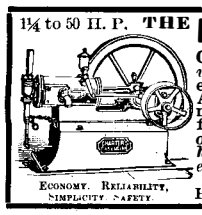


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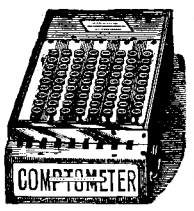
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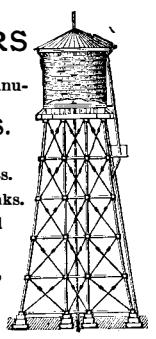
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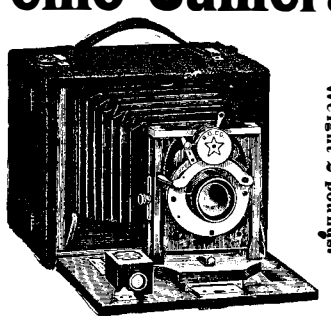
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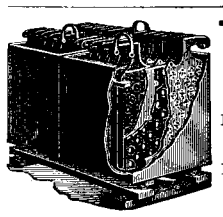
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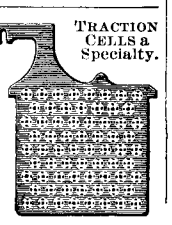
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